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ROYAL BOTANIC GARDENS, KEW

LI—A STUDY OF POLYSTICTUS VERSICOLOR.

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Introduction.

It is hardly an exaggeration to say that most of the rot of felled hardwoods in Britain, under damp conditions, has been caused, at least partially, by *Polystictus versicolor* (L.) Fr. ; and Von Schrenk and Spaulding describe it as the " . . . most serious of all wood rotting fungi which attack dead wood of broadleaf trees." Also as " . . . one of the most cosmopolitan species of fungus on the sapwood, on every broadleaf species of tree known." Its fructifications are to be found on stumps of trees, gateposts, wooden fences and in fact on any untreated hardwood exposed to the weather, or under other damp conditions. It has also been reported to cause rot in the wooden frames of car bodies. The presence of the fungus has been reported from every country on the continent of Europe and also in America, where it is stated to cause a wet decay in the middle of limbs of apple (1). Bayliss (2) calls it a " pure saprophyte " but Von Schrenk and Spaulding say it is a wound parasite on hardy Catalpa, and Zeller states that it causes " heart rot canker." In this country however, it has not been reported as a parasite or even as causing decay of heart wood of standing trees. In the beech woods of the Chilterns practically every stump and felled tree shows the fruit bodies of *P. versicolor*, but I have never found the fungus in any living tree in spite of careful observation over a considerable period.

Previous Work.

Despite the extreme economic importance of *Polystictus versicolor* there has been little previous experimental work on it published, and no really comprehensive study of its effect upon wood. Bayliss's paper in 1908 (2) deals mainly with the microscopic details of hyphae and the fungus in hanging drop cultures, etc., and gives an outline of its effect upon wood. Fritz (5) also gives notes on the fungus in culture and describes its growth on a number of different media. Walpert (8) indicates the growth of Polystictus with regard to the Hydrogen ion concentration of the medium. N. E. Stevens (7) describes the fungus as causing a rot of the hardy Catalpa ; and Weir (9) and Zeller (10) deal with its rare parasitism on a few species of trees. The chemical action of the fungus upon wood has been investigated by R. G. Smith (6) and W. G. Campbell (3). Short descriptions of the fruit-bodies have been given by many authors and may in fact be found in most text books on mycology.

Fruit bodies.

The individual sporophores are small, seldom exceeding 6 to 8 cms. wide and 4 cms. deep, but they are conspicuous owing to large numbers forming dense masses and overlapping one another, often covering an entire tree stump. They may be bracket-shaped or resupinate according to their position, though even in the former instance there is no true stipe, the pileus sometimes narrowing slightly at the point of attachment. When young the sporophore is white and fleshy but with age it becomes leathery and the upper surface is divided into a number of concentric zones of varying shades of yellow and brown, which are also troughs of varying depths; the whole surface is covered with short fine hairs, giving it a velvety texture. The margin is irregularly lobed and thin; the lower surface retains its white colour throughout life; the pore orifices are round when young, becoming rather torn later. The shape of the pileus varies considerably but is generally more or less fan-shaped. Both the shape and colouring of fruit-bodies vary with their position, amount of light and moisture, and to a certain extent with the host.

The fungus in culture.

The medium almost exclusively used was malt extract agar (2% Kepler's malt extract and 2% agar-agar in water), in which the fungus grew vigorously; thicker but slower growth was obtained by the addition of 1% of malic acid, and this was used when such a growth was desired.

Plates of 2% malt agar were inoculated from a sub-culture of *P. versicolor* obtained from the Forest Products Research Laboratory, Princes Risborough, and kept in the light at laboratory temperature. Slope cultures in test tubes were also made and placed under the same conditions; the appearance of these being noted from day to day. After a fortnight both plates and slopes were covered with a smooth, closely woven mat of rather felty-looking mycelium appressed to the medium; in some plate cultures there was a slight tendency to zonation, but the zones were not very marked nor regular and consisted of a thicker growth of mycelium with no sign of secondary spore or conidia formation; also with age the zones disappeared. In the majority of cultures growth was very even, and the margin of the colony formed an unbroken circle. The colour of the mycelium was pure white with only the slightest yellowing in some cases after a month or so; in many cultures the mycelium tended to become slightly and patchily colourless and translucent, but this was not so in all cases and after six weeks to two months many of the patches became white again. The rate of growth was fairly fast, the whole plate (about 8 cms. diameter) being covered in about two weeks, at about 18°C. Tube cultures showed a similar kind of growth but that the mycelium was of a rather more feathery texture especially towards the base of the slope, due to the moister condition of the agar and its greater

thickness. The slopes were covered in six to eight days. In no case were any fruit bodies found. The fungus had the striking effect in both plate and tube cultures, of decolorising the medium, which was, when inoculated, a deep brown and became after three weeks to a month entirely colourless ; this is a useful test in identifying *P. versicolor*, although this may be shown by other species.

Cultures three and four months old did not differ greatly from those one month old, except that some became more colourless and presented a rather granular appearance, the mycelium being formed into a white powder at the edge of, and, to some extent, all over the colourless portions ; this powder was not formed of spores but of interweaving hyphae. Submerged in the medium of old cultures appeared small dark specks the size of a pin-hole and brown in colour. Microscopic examination showed them to be masses of disintegrated hyphae containing some yellow fluid, probably oil (a degeneration product). Drops of a brown fluid were exuded from old cultures and were particularly noticeable in tube cultures.

Microscopic details of Fungus.—(1) Young hyphae : less vacuolated than the older hyphae and also less freely branched ; clamp connections are few in very young hyphae. Size 2–4μ wide.

(2) Mature Hyphae :
(a) Aerial : (taken from feathery growth on acid medium). Not very much branched and with relatively few septa but most septa provided with clamp connections. In all cases

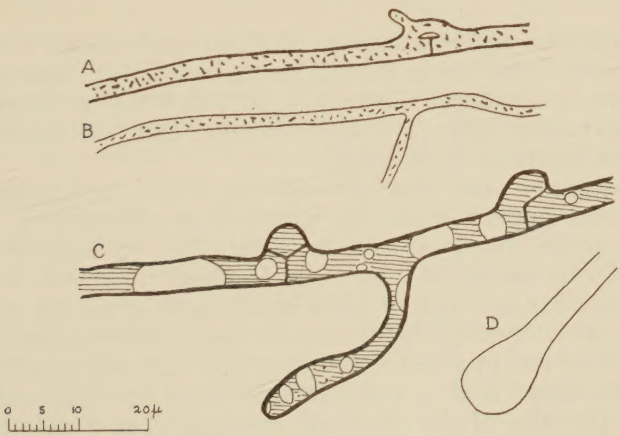


Fig. 1. A, Hypha showing granular deposits in cell sap and branch from clamp connection. B, narrow hypha. C, older hypha showing great vacuolation and clamp connections. D, swollen end of hypha.

the hyphae are hyaline. It was noticed that a large number of branches arose from clamp connections. A number of hyphal tips were swollen, and in some cases bifurcated ;

there seemed to be no specific reason for this, as the tips observed were free in medium and not attempting to penetrate the membrane of a host. The average size of hyphae is 3–4μ wide.

(b) Submerged hyphae : More freely branching than aerial hyphae and with many more septa, also they are more vacuolate and larger ; their average width being 3–6μ. In old cultures frequent thick walled hyphae were seen.

(3) Clamp connections : very abundant especially in vigorously growing cultures, being less frequent in very old and very young hyphae. They vary somewhat in size.

(4) Crystals : small groups of needle-shaped crystals were found in slide cultures of *P. versicolor* on 2% malt agar (filtered) after a few days growth, but were absent from plate cultures except when the medium had almost dried up, which suggests that their formation was due to the medium being exhausted quickly or to an insufficiency of moisture. Rhomboidal crystals of varying size were present in most cultures, especially old ones.

Fruit bodies in culture. Fruit bodies were not obtained in culture in spite of many experiments such as (1) growing the fungus at different concentrations of malt agar (0·5% to 10%). (2) Using liquid media. (3) making the surface of a solid medium vertical. (4) using media of various pH values. (5) growing cultures at different temperatures. (6) using aerated media such as bread and loofah soaked in a broth of malt extract. In the last experiment small knobs of mycelium formed on the bread but did not develop further.

Cultures from different sources. Cultures were made from spores of fruit-bodies taken from several hosts, beech, oak, ash, hornbeam and cherry being used. There was no difference in the mycelium either macroscopically or microscopically and the effect on the media was identical in all cases.

Basidio-spores and their germination. The basidio-spores are hyaline and appear white in mass ; they are formed in great abundance, are oblong to oval in shape, 2 to 4μ wide by 6 to 8μ long, and are surrounded by a fairly thick wall ; the cytoplasm usually contains one, two or more small, dark, granular masses.

Germination in sterile distilled water takes place readily in twenty-four hours, or less in a nutrient medium ; it is greatly affected by air, even to the extent that in a slide culture (malt broth as medium) the spores at the edge of the cover-slip germinated in a day, but those in the middle did not germinate after many weeks, although constant fresh supplies of malt broth were introduced under the cover-slip before the old dried up. Germ-tubes may arise from any part of the spore and grow very rapidly.

Hanging-drop culture of spores : considerable growth took place for 6 to 7 days and then the hyphae walls became rather contorted in outline and the contents tended to split up in short

lengths (4 to 8μ long), but the actual wall did not break up, and the hyphae remained in this state for several months. No indication of the pale green buds reported by Bayliss was seen. Numerous rod-shaped crystals (4 to 8μ long by 1μ wide) were formed in the medium after a week or so.

Monosporous culture : made in 0·5% filtered malt agar. After twenty-four hours a primary mycelium was formed, considerably branched, unseptate and the hyphae being about 4μ in diameter. A further nineteen hours later the mycelium had more than doubled its growth and many new branches were formed, but no septa appeared nor clamp connections.

Fig. 2. Germinating basidiospores. A, granules in cytoplasm.

In less than a week a good growth of mycelium had been formed and from this a single hyphal tip was taken and placed on a plate of 2·0% malt agar where it grew strongly, without septa or clamp connections, covering the plate in under a fortnight and with the same texture as the culture described on page 410.

Finally two monosporous cultures were started on one plate of malt agar and allowed to grow together : at the meeting of the two haploid mycelia a diploid mycelium was formed.

Vitality of spores : spores retain their vitality for considerable periods and fruit-bodies collected in a dried up condition (in which state they had probably been for several months) and kept in the laboratory for a further three months, on soaking in water, yielded spores which germinated freely. A further experiment consisted of placing a drop of a thick spore-suspension in sterile distilled water on a slide and adding a cover-slip ; this was allowed to dry out before many of the spores had time to germinate, and in the dry state kept for three months, at the end of which time a nutrient solution was introduced under the cover-clip. The spores then germinated quite readily.

Physiological Work.

The effect of the acidity of the medium on the fungus.—Plate cultures of 2·0% malt agar were prepared with 1·0% of the following acids added : tartaric, lactic, hydrochloric, sulphuric, nitric, acetic

and malic. Vigorous growth resulted on malic acid plates, very poor growth on tartaric acid plates and none at all on any other. Malic acid thus being found to be most favourable to the growth of the fungus, further plates and slopes of malt agar were made with 1·0% of that acid and kept under different conditions, viz. :

(1) In the light at laboratory temperature.
(2) In the dark at laboratory temperature.
(3) in the dark but incubated at 23°C.

In all cases growth was much slower than on unacidified medium but a thicker and more feathery mycelium resulted. The colonies also were irregular in outline, unlike the circular colonies previously described. There was some uneven zoning in most cultures except those grown in the light.

In order to determine more exactly the effect of the pH value of the medium on the fungus, tubes of Richards's solution plus 1·5% agar were prepared, and varying amounts of malic acid or potassium hydroxide added, samples being extracted and their pH determined ; after the medium had been well mixed it was poured into plates, inoculated and incubated at 23°C. The cultures were examined periodically during four weeks, when it was found that no growth took place at pH below 3·0 nor above 7·3, while maximum growth occurred at 4·6 to 5·6. These results agree fairly well with Walpert's (8) although he used a liquid medium. He gives the limits for growth as pH 2·5 to 7·6 at 25°C.

Temperature effect of the rate of growth.—In a recent paper, Cartwright and Findlay (4) state that *P. versicolor* possesses a very wide temperature range with an optimum about 28–30°C. The following table is taken from this paper :—

TABLE A.

Temperature (°C)	9	14	20	23	25	27	30	35	38
Average daily increment (mm.)	4·6	7·1	11·2	13·5	16·0	18·3	19·1	9·4	0·8

They also observe that Petri dish cultures vary greatly according to the temperature at which they are grown : " at 20°C. a young culture consists of a rather sparse adpressed mycelium with a loose cottony margin, and later a thin leathery skin-like mat is produced, while at 35°C. it forms a rather silky, somewhat branched, bushy mat with much more initial development of aerial mycelium."

Lethal temperature.—To determine the temperature required to kill the fungus in culture two methods were employed, viz.:—

(1) Inocula were taken from slope cultures in test-tubes which had been kept in a water bath at different temperatures for a given period (15 minutes) and transferred to fresh slopes, then incubated and any growth noted.

(2) An identical method to the preceding one except that the cultures used were in malt broth.

Both these methods produce the same result. The first range of temperatures used was : 40°C., 45°C., 50°C., 55°C., and 60°C., and growth took place from all inocula (three for each temperature

variation) except that at 60°C. Hence the lethal temperature lies between 55°C. and 60°C. To obtain a more accurate result the experiment was repeated at 56°C. and 58°C., and growth occurred at both these temperatures ; thus the lowest lethal temperature for a period of 15 minutes is 60°C. The time required to kill the fungus at different temperatures was then investigated, the same technique as before being used. The following results were obtained :—

Temperature	Time in hours	Resulting growth
45°C.	1	+
	2	+
	4	+
50°C.	1	+
	2	+
	$2\frac{1}{2}$	+
	3	−
	$3\frac{1}{2}$	−
55°C.	1	+
	2	−
	3	−
60°C.	$\frac{1}{4}$	−

TABLE I.

All sub cultures were incubated for a month before it was assumed that no growth would take place.

Lethal temperature of the fungus in wood.—Small pieces were cut from a block of hornbeam well rotted by the fungus and placed in Petri dishes, the atmosphere in which was kept moist by the presence of wet filter paper. These were kept almost saturated in an oven for varying times at different temperatures, and then placed on plates of 2·0% malt agar and incubated.

Temperature	Time in hours	Growth of fungus 1	2	3
50°C.	1	+	+	+
	2	−	−	−
	3	−	−	−
	4	−	−	−
55°C.	1	+	+	+
	2	−	−	−
60°C.	$\frac{1}{4}$	+	+	+
	$\frac{1}{2}$	−	−	−
65°C.	$\frac{1}{4}$	−	−	−
70°C.	$\frac{1}{4}$	−	−	−

TABLE II.

Concentration of medium effect on growth.—Plate cultures of *P. versicolor* on varying concentrations of malt agar, were incubated at 23°C. and the diameter of the colonies grown measured periodically. The graph of figure 3 gives the results of this experiment, based on the measurement of four plates. It is seen that the rate of growth

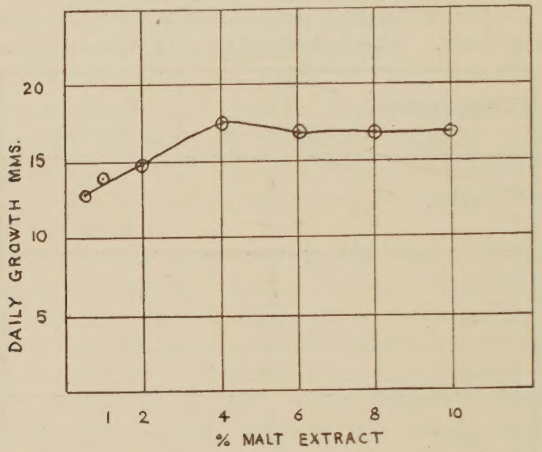


Fig. 3. Graph showing effect of concentration of medium on growth.

is least at 0·5 and 1·0%, reaches a maximum at 4·0% and is constant at the higher concentrations 6, 8 and 10%. With the increase of malt extract there is a corresponding thickening of the mycelial mat, though little difference can be noticed between the 8% and 10% cultures.

Effect of light on rate of growth.—Eight plate cultures kept in the dark showed a somewhat increased growth over eight exposed to

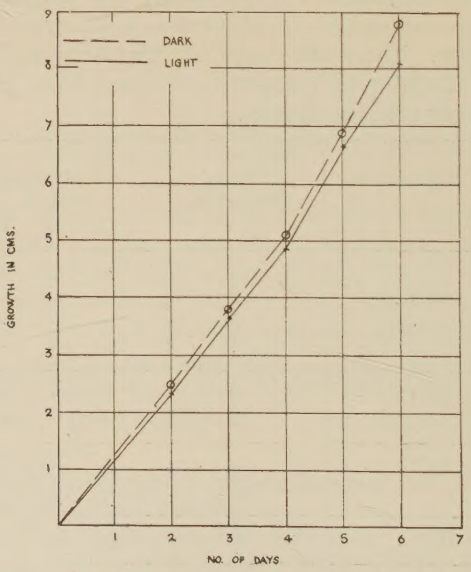


Fig. 4. Graph showing effect of light on growth.

Plate X.

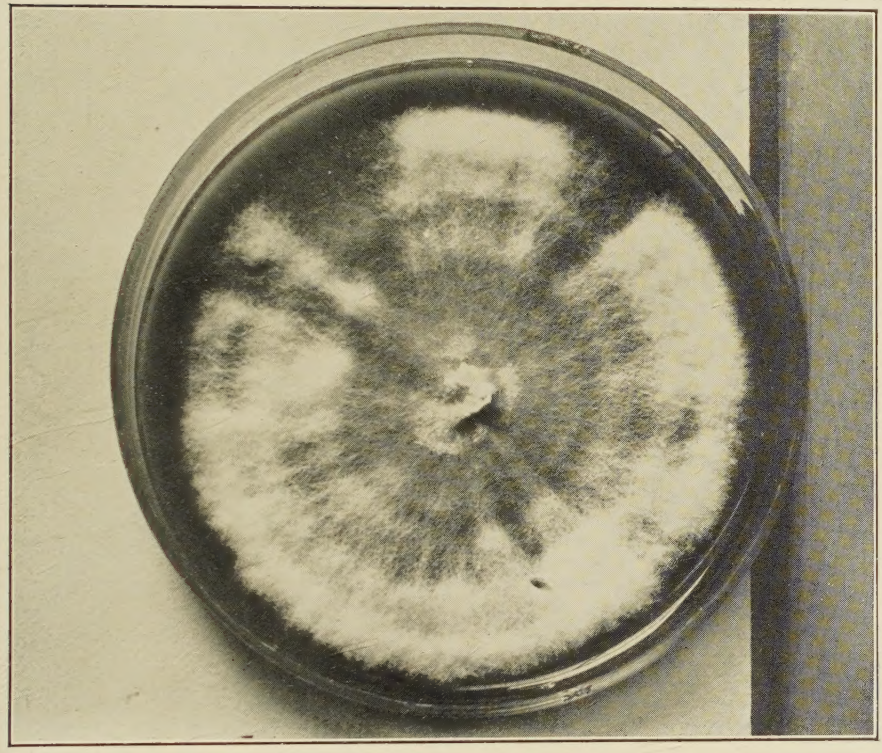
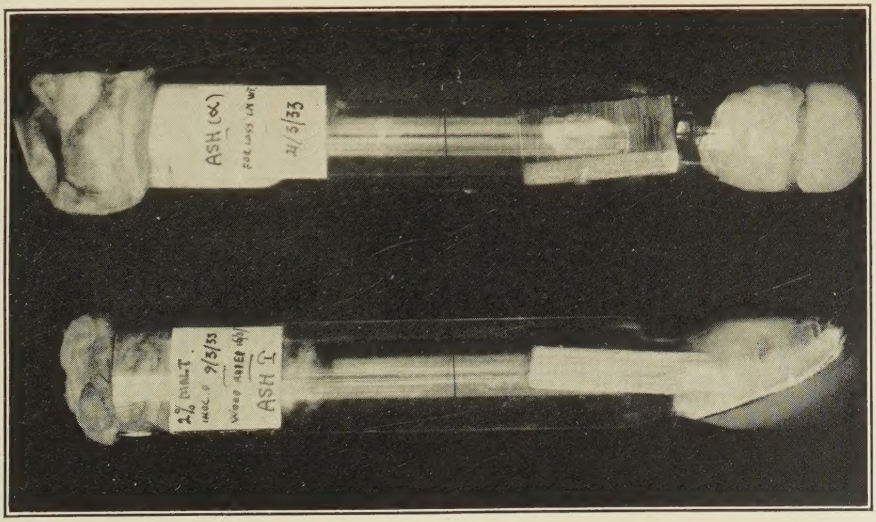


Plate culture of *P. versicolor* on acidified malt agar; 10 days growth.



B A
Methods of inoculating wood blocks.

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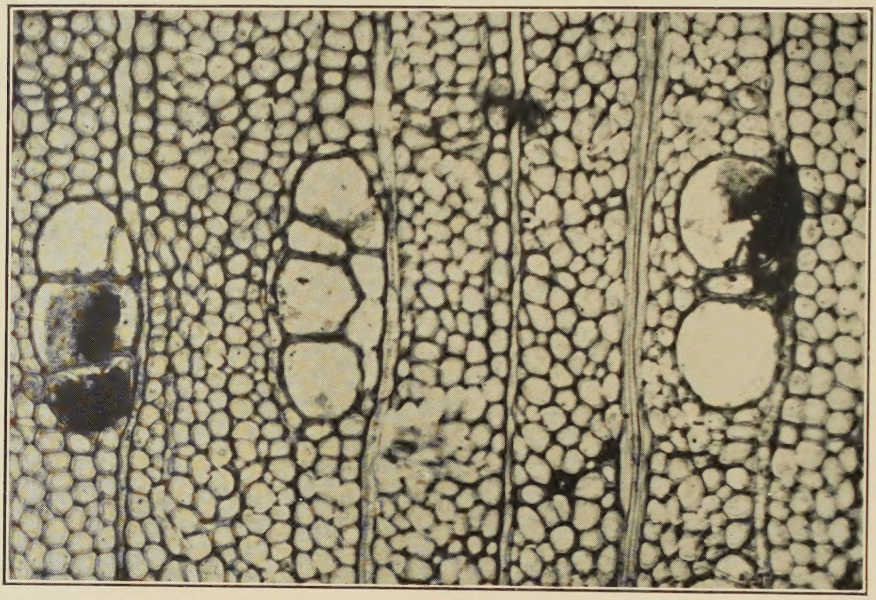
PLATE XI.



Transverse section of *Carpinus Betulus* showing mycelium massed in some vessels and absent in others.

Radial section of *Quercus pedunculata* showing formation of gum and myceliuns in cells (×131)

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the light, though in the former case the mycelium was very slightly thinner.

The Fungus on Wood.

Naturally infected pieces of a branch of bird cherry (*Prunus Padus* L.) were kept in Petri dishes on pads of moist filter-paper. Very little mycelium was produced on the outside of the blocks, but on splitting them up when well decayed, the wood came away in concentric layers, each layer an annual ring, and between each of these rings was a thin papery sheet of mycelium, white in colour, closely woven and exactly resembling the mycelium on unacidified medium in agar culture. The fungus caused the wood to become white, first in patches, and in very decayed specimens, all over. This is due to the lignin being more vigorously attacked than the cellulose, resulting in an apparent accumulation of cellulose. This type of attack is given the name of "white rot." Small, but otherwise normal fruit bodies were produced on these blocks after some time.

A number of blocks of various common hardwoods, artificially infected with *P. versicolor*, showed a gradual bleaching and softening of the outer layers of the wood, although the splitting along rings as described above, did not occur. Upon drying the wood when in advanced state of decay it readily crumbled and some shrinkage took place, especially in the case of ash, but no cracking was observed.

In the ultimate stage of decay the wood is throughout white in colour.

Methods of inoculation of wood blocks.—Various methods of inoculating wood blocks were used in order to determine the most satisfactory and quickest means of infecting wood.

(1) Plugs of cotton wool were placed at the bottom of Roux tubes and kept moist with water, the wood being prevented from touching the wool by the constriction of the tube. A small transplant from an agar culture was then put on the wood and the tube plugged with cotton wool and incubated. (See Plate Xa). This method was extremely slow, and the necessity for removing the plug from time to time to add more sterile water gave a chance of contamination.

(2) A better method than the above was to make slope cultures (of 2·0% malt agar) in Roux tubes, the slope being so arranged that the agar came just above the constriction in the tube, the slopes were then inoculated with the fungus and when good growth had taken place the wood was added, its size being such that it just reached the constriction of the tube. This allowed the wood to be attacked by the fungus without its being stained by the medium or becoming too wet. As before, the tube was plugged and incubated. (See Plate Xb.) This method, although permitting more vigorous attack than the first, still took a long time before the wood was rotted to any extent.

(3) The quickest and most thorough attack of wood by the fungus was obtained by laying the wood blocks on a strongly growing mycelium on malt agar, in conical flasks, or boiling tubes. By this method considerable decay was produced in two months.

All three of the above methods were tested with blocks of ash and oak.

Details of the fungus mycelium in wood.—Numerous small blocks of elm and oak (*Q. pedunculata* Ehrh.) cut so that the rays were parallel with the sides, were exposed to attack by the fungus in the manner described in method (3) in the preceding paragraph. They were removed at periods varying from 1 to 13 weeks, sectioned, stained by the picro-aniline blue method and mounted. Rotted blocks of ash, hornbeam, beech and red oak were also examined. The fungus penetrates the wood along the vessels and medullary rays, which latter are the first objects of attack ; later on the wood parenchyma cells are vigorously attacked and the smaller vessels are filled with dense strands of interweaving hyphae. The hyphae are hyaline and their size varies considerably, some being very small, 2 to 3μ wide, and others much larger, 5 to 7μ wide, but generally they are about 3 to 4μ in width. Clamp connections are fairly frequent though not so much so as in agar culture, and very rarely " medallions " (clamp connections of a symmetrical structure), are formed. Hyphae appear to pass from one cell to another by pits or by penetrating the wall with equal readiness ; in the latter case they may or may not be constricted, though in the majority of

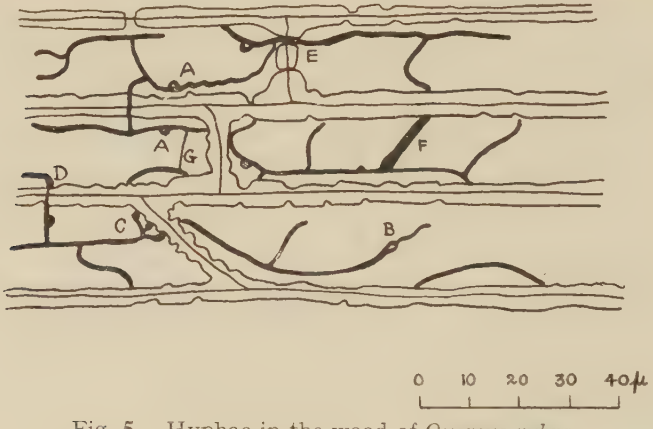

Fig. 5. Hyphae in the wood of *Quercus rubra.*
Ray cells showing clamp connections at A. B, medallion (?). C, hyphae swollen at the tip before penetrating cell wall. D, constricted hypha passing through cell wall. E, hypha passing through pit. F, thick hypha. G, thin hypha.

cases they are slightly constricted. Often the hyphal tips swell in contact with the cell wall before piercing it. In the case of oak (not in any other wood observed) a zone line appears, caused by the elements of the wood being filled with a gummy substance of a

red-brown colour ; this marks the limit of progress of the mycelium. In more advanced stages of attack, the cell walls are not stained evenly by safranin, showing their delignification ; the phloroglucin test, however, indicates the presence of some lignin, though the reaction is very much slower than with sound wood.

Wood blocks were placed on monosporous cultures in order to discover if the haploid mycelium of *P. versicolor* had any destructive effect upon wood. On sectioning the blocks after only 2 weeks, it was found that the fungus had penetrated the wood and was attacking it as vigorously and in the same manner as the diploid mycelium described above. No clamp connections were seen.

Loss in weight of wood attacked by P. versicolor.—In order to discover the maximum loss of dry weight caused by the fungus in wood, blocks of ash, beech and elm were dried at about 90°C. until no further loss of weight resulted, the dry-weights were then noted, the blocks soaked in water and laid on actively growing cultures of the fungus in flasks ; they were kept moist over a period of 4 months by the frequent addition of sterile water. Very vigorous fungous attack was obtained and at the end of the period the blocks were soft to the touch, the ash especially being a pulpy mass ; in all cases bleaching of the wood was very noticeable. After removal the blocks were dried and their dry weights compared with those determined before the experiment. The greatest loss of weight was 80% in one ash block.

Reaction of the Fungus to Wood Preservatives.

Preservatives in agar cultures.—Sodium fluoride. The fluoride used was the commercial form used in the actual preservation of timber. It was made up into an aqueous solution and sterilised in the autoclave to avoid any possible contamination. Calculated amounts were then added to sterile eight-ounce bottles and corresponding volumes of 2·0% malt agar were run in from a sterile burette ; by shaking the bottles vigorously the preservative was well mixed with the agar and the mixture was then quickly poured into plates (four for each concentration) ; when the agar had set the plates were inoculated with small square transplants (about 5 or 6 mm. square) from an actively growing plate culture, and then incubated at 23°C. The concentrations of sodium fluoride used were 0·005%, 0·05%, 0·2%, 0·5%, 0·7%, and 1·0%. After a week the cultures were examined and vigorous growth had taken place at 0·005% sodium fluoride, the colonies being 4 to 5 cms. across and of a thick texture ; the 0·05% plate showed growth of a thinner nature and less extensive (under 4 cm.). On none of the other plates could any growth at all be seen, and a further ten days incubation produced no signs of growth. The approximate toxic (inhibition) point having been ascertained (i.e. between 0·05 and 0·2%) a more exact percentage was sought by making a further series of plates in the manner already described of 0·08%, 0·1%, 0·15% and 0·18% of the preservative ; after eight days incubation the plates

showed very slight growth in all cases, though the mycelium in the 0·18% concentration was only just visible through a lens ; hence the toxic point is 0·2% sodium fluoride.

Creosote. As with sodium fluoride, a commercial sample of coal-tar-creosote B.S.S. Type A was used. Since it cannot be simply diluted with water it was emulsified with 20·0% gum arabic by shaking the desired quantities together in glass-stoppered bottles for long periods. Using this emulsion, the method of the previous experiment was used in preparing a series of plates containing the following concentrations of creosote : 0·005%, 0·05% 0·1%, 0·5%, 0·8%, and 1·0%. A fluffy growth of mycelium was formed after seven days incubation on the 0·005% and the 0·05% plates but none on any other plates. Further incubation produced no sign of growth. The toxic point of creosote to *P. versicolor* is therefore between 0·05% and 0·1%.

Formalin vapour. A strongly growing plate-culture was inverted over the mouth of a large beaker, in the bottom of which was a pad of filter-paper soaked in formalin ; the plate and mouth of the beaker were then covered with a piece of paper which was held in place by means of a rubber band ; this prevented any of the vapour of the formalin from escaping. At half hourly intervals the plate was removed and three transplants taken from it and sown on 2·0% malt slopes, which were incubated and examined weekly. Exposure of half an hour to the vapour seemed to act as a stimulant on the fungus, resulting in a very thick growth, but only slight growth was obtained, after several weeks, from inocula exposed for an hour to the vapour and none at all from those exposed for two hours.

Lethal effect of wood preservatives. In order to ascertain the amount of wood-preservative necessary to kill the fungus and not merely to inhibit growth (as in the previous experiment), the old inocula on the preservative plates where no growth had taken place were placed on 2·0% malt agar slopes and incubated at 23°C. The following results were obtained :

Sodium fluoride				Creosote				Zinc chloride	
0·2%	0·5%	0·7%	1·0%	0·2%	0·5%	0·8%	1·0%	0·5%	1·0%
+	–	–	–	+	–	–	–	–	–

TABLE III.

Wood treated with preservatives.—In order to determine the smallest amount of preservatives necessary to prevent the growth of *P. versicolor*, sticks of various hardwoods (2½ ins. x ½ in. x ½ in.) were soaked in different concentrations of commercial sodium fluoride for four hours in a vacuum, dried and placed on slope cultures of the fungus in boiling tubes (7 x ¾ ins.). After four

months the sticks were removed, their oven-dry weights determined and compared with those found before the experiment.

A similar experiment was carried out, using commercial coal-tar creosote emulsified with gum arabic and small milk-bottles instead of boiling tubes. The results of these experiments are given in the following tables:

TABLE IV.

Beech blocks + NaF.

	Air dry wt : gms.	Calculated oven dry wt : gms.	Wet wt : after 4 months gms.	Oven-dry wt : after experiment gms.	Loss in dry wt : gms.	% loss in wt :	Average % loss in wt :
Controls soaked in water—							
1.	5·72	5·47	6·34	3·18	2·29	41·8	
2.	5·42	5·20	8·37	4·93	0·3	6·0	
3.	5·69	5·46	8·83	5·02	0·44	8·0	
Soaked in 0·1% NaF—							
4.	4·78	4·60	7·60	4·09	0·51	11·0	
5.	5·63	5·40	8·81	5·08	0·32	5·9	7·7
6.	5·28	5·07	8·34	4·75	0·32	6·3	
Soaked in 0·5% NaF—							
7.	5·20	4·99	7·18	4·99	—	—	
8.	5·77	5·46	7·31	5·48	—	—	—
9.	5·44	5·22	7·56	5·17	—	—	
Soaked in 1·0% NaF—							
10.	5·96	5·72	7·94	5·77	—	—	
11.	5·26	5·05	7·24	5·11	—	—	—
12.	4·73	4·54	6·34	4·57	—	—	
Soaked in 2·0% NaF—							
13.	5·53	5·31	7·83	5·36	—	—	
14.	4·94	4·75	7·28	4·79	—	—	—
15.	4·68	4·50	7·37	4·54	—	—	

Air-dry wt : gms.	Calculated oven-dry wt : gms.	Oven-dry wt : after experiment gms.	Loss in dry wt : gms.	% loss in wt.	Average % loss in wt :
Controls soaked in water—					
1. 4·685	4·12	2·32	1·81	43·9	
2. 4·01	3·53	1·71	1·82	51·6	46·5
3. 4·98	4·38	2·41	1·97	45·0	
Soaked in 0·1 % NaF—					
4. 3·84	3·38	2·50	0·85	25·1	
5. 4·21	3·70	2·80	0·90	24·3	22·1
6. 4·87	4·29	3·53	0·77	17·9	
Soaked in 0·5 % NaF—					
7. 4·30	3·78	3·64	0·14	3·7	
8. 3·53	3·11	2·95	0·16	5·1	4·6
9. 4·34	3·82	3·63	0·19	5·0	
Soaked in 1·0 % NaF—					
10. 4·14	3·64	3·48	0·16	4·4	
11. 3·92	3·45	3·32	0·13	3·8	3·3
12. 3·80	3·34	3·28	0·06	1·8	
Soaked in 2·0 % NaF—					
13. 4·65	4·09	4·07	—	—	
14. 3·71	3·26	3·26	—	—	—
15. 4·42	3·89	3·89	—	—	

Ash blocks + NaF. TABLE V.

Air dry wt : gms.	Calculated oven-dry wt : gms.	Oven-dry wt ; after experiment gms.	Loss in dry wt : gms.	% loss in wt :	Average % loss in wt:
Controls soaked in water—					
1. 3·04	2·83	1·32	1·48	52·3	
2. 4·19	3·90	1·83	2·07	53·1	50·3
3. 3·40	3·16	1·72	1·44	45·6	
Soaked in 0·1 % NaF—					
4. 3·70	3·44	3·12	0·32	9·3	
5. 3·43	3·19	2·98	0·21	6·6	
6. 3·54	3·29	3·10	0·19	5·8	
Soaked in 0·5 % NaF—					
7. 3·39	3·15	3·01	0·14	4·4	
8. 3·67	3·31	3·21	0·10	3·0	3·8
9. 3·42	3·18	3·06	0·12	3·8	
10. 3·02	2·81	2·69	0·12	4·2	
Soaked in 1·0 % NaF—					
11. 3·72	3·46	3·39	0·07	2·0	
12. 3·41	3·17	3·12	0·05	1·6	2·9
13. 4·04	3·76	3·64	0·12	3·2	
14. 2·67	2·48	2·36	0·12	4·8	
Soaked in 2·0 % NaF—					
15. 3·49	3·25	3·23	0·02	0·6	
16. 4·06	3·78	3·75	0·03	0·8	0·7
17. 3·48	3·24	3·22	0·02	0·6	
18. 3·66	3·40	3·37	0·03	0·9	

Elm blocks +NaF. TABLE VI.

Air dry wt : gms.	Calculated oven-dry wt.: gms.	Oven-dry wt : after experiment gms.	Loss in dry wt : gms.	% loss in wt :	Average % loss in wt :
Controls soaked in water—					
1. 8·33	7·23	6·50	0·47	6·6	
2. 29·74	22·53	12·55	9·98	44·3	
Soaked in 0·1 % *Creosote—*					
3. 8·23	7·14	6·75	0·38	5·4	4·3
4. 8·02	6·96	6·73	0·23	3·3	
Soaked in 0·5 % *creosote—*					
5. 7·38	6·40	6·17	0·23	3·6	4·6
6. 7·77	6·74	6·36	0·38	5·6	
Soaked in 1·0 % *creosote—*					
7. 8·87	7·70	7·48	0·22	2·8	3·8
8. 8·42	7·31	6·96	0·35	4·8	
Soaked in 2·0 % *creosote—*					
9. 8·00	6·95	6·85	0·09	1·3	0·8
10. 8·46	7·34	7·32	0·02	0·27	

TABLE VII.

Beech blocks + creosote.

(It will be noticed in the foregoing tables that the control blocks of one species show widely divergent figures for loss of weight in one or two cases, and so have not been averaged. This divergence may be due to some difference in original moisture content of the wood or to other, unknown factors.)

The heartwood of oak (*Quercus pedunculata*) was treated similarly to the foregoing woods, but its resistance to the fungus was so great that a loss of only 2·6% was obtained in the control sticks, 1·6% in those soaked in 0·1% sodium fluoride, and no loss at all in any other concentration of preservative.

PREVENTION OF DECAY BY P. VERSICOLOR.

Since *P. versicolor* is most destructive to wood exposed to the weather where dry conditions are impossible, the best methods of prevention are either to creosote such permanent erections as fences etc. or to remove felled trunks as soon as possible from the forest in order that they may be dried before the rot begins. Where creosote impregnation is impossible, as in the case of car-bodywork, treatment with sodium fluoride solution is to be recommended. A four per cent. concentration of this preservative should be ample, as long as water is prevented from reaching the wood, which will both tend to wash out the preservative and produce favourable conditions for the fungus growth.

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Summary.

1. The economic importance, occurrence and distribution of *Polystictus versicolor* L. are described.

2. An account is given of previous work on the fungus. Fruit bodies and the fungus in culture are described and the microscopic details of the hyphae given.

3. Cultures from different sources are found to be identical. The germination of the basidio-spores is figured.

4. The effects of various pH values, temperature and concentrations of malt extract on the growth of the fungus are examined.

5. The fungus in wood is described, together with details of the hyphae in the cells and the effect upon the wood substance.

6. Experiments indicate the reaction of the fungus to preservatives in agar culture and wood, and suggestions are made for the prevention of decay caused by the fungus.

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LII—NOTES ON AFRICAN GRASSES: XVII.*

C. E. Hubbard.

Arundinella Ecklonii *Nees* var. **major** *C. E. Hubbard*, var. nov.; a typo differt culmis robustis 1·5–3 m. altis, foliorum laminis usque ad 1·8 cm. latis, panicula 30–52 cm. longa.

French Guinea: Fouta Djalon; Mali, *Chevalier* 34601 bis; between Lobé and Mali, *Chevalier* 34593 (type).

Trichopteryx fruticulosa *Chiov.* var. **Whytei** *C. E. Hubbard*, var. nov.; a typo differt glumis laxe pilosis vel glabris, lemmate superiore 2–2·5 mm. longo setis lateralibus 0·5–2·5 mm. longis, aristis 8–10 mm. longis columna 2·5–3 mm. longa, antheris 2 mm. longis.

Tanganyika Territory: Mbeya District; Unyamwaya, 1800 m., *Davies* 168; Kyimbila District, *Stolz* 1229, 1361.

Nyasaland: Kondowe to Karonga, 600-1800 m., *Whyte* (type); Nyika Plateau, 1800–2100 m., *Whyte*.

Trichopteryx gracillima *C. E. Hubbard*, sp. nov.; affinis *T. marungensi* Chiov., sed foliorum laminis anguste lanceolatis, aristis paullo brevioribus, glumis minute pubescentibus differt.

Gramen perenne (?). *Culmi* geniculato-ascendentes, usque ad 45 cm. alti, gracillimi, filiformes, ramosi, multinodes, minute pubescentes. *Foliorum vaginae* internodiis multo breviores, 1·2–4 cm. longae, minute pubescentes; ligulae ad seriem ciliorum redactae; laminae anguste lanceolatae, basi contractae, acutae, usque ad 2·5 cm. longae et 3·5 mm. latae, planae, firmae, minute pubescentes, marginibus scaberulis cartilagineis. *Panicula* laxa, 5–10 cm. longa, usque ad 3·2 cm. lata; rhachis filiformis, inferne minute pubescens, superne asperula; rami capillares, flexuosi, apicem versus laxe divisi, asperuli, inferiores binati vel solitarii, usque ad 4·5 cm. longi, intermedii fasciculati vel semi-verticillati; pedicelli usque ad 6 mm. longi. *Spiculae* lanceolatae et acuminatae vel anguste oblongae et hiantes, 3·5–4 mm. longae, badiae. *Glumae* tenuiter chartaceae, trinerves, pilis brevissimis e tuberculis minutis ortis pubescentes; inferior lanceolata, acuta vel obtusa, 2·5–3 mm. longa; superior lanceolata, acuminata, apice acuta, usque ad 4 mm. longa. *Anthoecium inferum* ♂: lemma glumae superiori simile, spiculam aequans, margines versus sparse pubescens; palea linearis, 3 mm. longa, obtusa. *Anthoecium superum* lineare, albidum, demum brunneum: callus minutus, truncatus, barbatus; lemma 2 mm. longum, bilobum, lobis 0·5 mm. longis in setam scaberulam capillarem circiter 2 mm. longam plerumque attenuatis, membranaceum, 5-nerve, infra medium pubescens, infra lobos pilis brevibus albis dense barbatum; arista geniculata, 8–9 mm. longa, columna scaberula 3·5–4 mm.

* Continued from K.B. 1934, 202.

longa ; palea linearis, 2·5 mm. longa. *Antherae* 2, 2 mm. longae. *Caryopsis* 1 mm. longa.

Uganda : Nabugabo, in swamp, in tufts of other grasses, 1200 m., *Thomas* 952.

Trichopteryx Glanvillei *C. E. Hubbard*, sp. nov. ; affinis *T. Stolzianae* Henrard, sed nodis barbatis, gluma superiore laxe pilosa, aristae columna breviore differt.

Gramen annuum. *Culmi* fasciculati, erecti vel geniculati, usque ad 10 cm. alti, gracillimi, 4–8-nodes, simplices vel ramosi, breviter pilosi. *Foliorum vaginae* usque ad 1·6 cm. longae, imbricatae vel inferiores demum internodiis paullo breviores, pubescentes vel pilosae, nodis breviter barbatis ; ligulae ad seriem ciliorum redactae ; laminae lanceolatae vel anguste ovatae, basi rotundatae, acutae, usque ad 2·2 cm. longae et 6 mm. latae, planae, patentes vel demum reflexae, dense pubescentes vel supra glabrescentes, marginibus scaberulis cartilagineis. *Panicula* contracta, usque ad 3.8 cm. longa ; rhachis superne minute scaberula ; rami capillares, flexuosi, scaberuli, laxe divisi ; pedicelli usque ad 6 mm. longi. *Spiculae* lanceolatae, demum hiantes, 3·5–4 mm. longae, flavido-brunneae. *Glumae* membranaceae, trinerves, pilis albis rigidis e tuberculis minutis ortis laxe vel sparse praeditae ; inferior anguste ovata vel ovato-oblonga, obtusa vel acuta, 2–2·5 mm. longa, mucronulata ; superior lanceolata, acute acuminata, spiculae aequilonga. *Anthoecium inferum* sterile : lemma glumae superiori simile, oblongo-lanceolatum, dorso pilis brevibus paucis praeditum, scabridulum ; palea oblongo-lanceolata, 2 mm. longa, hyalina, carinis minute ciliolatis. *Anthoecium superum* anguste oblongum, demum atro-brunneum : callus minutus, truncatus, barbatus ; lemma 1·5–2 mm. longum, bilobum, lobis in setam capillarem scaberulam usque ad 5 mm. longam attenuatis, demum tenuiter coriaceum, obscure 5–7-nerve, breviter pubescens, infra lobos pilis brevibus albis dense barbatum ; arista geniculata, scaberula, 8–10 mm. longa, columna scaberula 3 mm. longa ; palea lanceolato-oblonga, 2 mm. longa, inter carinas minute pubescens. *Antherae* 2, 0·6 mm. longae. *Caryopsis* oblonga, 1 mm. longa.

Sierra Leone : Bintumane, on the summit, 1890 m., *Glanville* 335.

Loudetia angolensis *C. E. Hubbard*, sp. nov. ; affinis *L. arundinaceae* Steud., sed spiculis minoribus, panicula contracta et densa angustiore, ramis brevioribus, foliorum laminis angustioribus et brevioribus differt.

Gramen perenne, e rhizomate brevi ortum ; innovationes extravaginales ; gemmae cataphyllis glabris coriaceis obtectae. *Culmi* erecti vel basi geniculati, usque ad 1·6 m. alti, validiusculi, teretes, simplices, 3–4-nodes, glabri laevesque. *Foliorum vaginae* striatae, nodis breviter barbatae, basales latae, persistentes, inferiores plus minusve hispidulae vel glabrae, superiores glabrae, internodiis

breviores ; ligulae ad seriem ciliorum brevium redactae ; laminae lineares, in apicem subobtusum attenuatae, usque ad 24 cm. longae et 7 mm. latae, planae vel convolutae, rigidae, hispidulae vel glabrescentes, scaberulae. *Panicula* anguste oblonga, contracta, densa, 20–45 cm. longa, 2·5–5 cm. lata ; rhachis scaberula ; rami verticillati vel semi-verticillati, densi, usque ad 9 cm. longi, divisi, tenuiter filiformes, scaberuli ; pedicelli 1–8 mm. (vel ultra) longi. *Spiculae* lanceolatae vel anguste oblongae, 6–7·5 mm. longae, brunneae. *Glumae* chartaceae, trinerves, pilis albis appressis e tuberculis minutis ortis laxe hirsutae ; inferior lanceolata vel ovata, obtusa vel truncata, 3-4 mm. longa ; superior lineari-lanceolata, truncata, spicula paullo brevior. *Anthoecium inferum* ♂ : lemma glumae superiori simile sed latius, spiculae aequilongum, minus hirsutum vel glabrum ; palea linearis, truncata, 4-6 mm. longa, apicem versus carinis minute ciliolata. *Anthoecium superum* lineare : callus truncatus, 0·5–0·7 mm. longus, barbatus ; lemma 4·5 mm. longum, acute bilobum, lobis usque ad 1 mm. longis, tenuiter coriaceum, 5–7-nerve, pubescens ; arista geniculata, 1·8–2·5 cm. longa, columna scaberula 6 mm. longa ; palea linearis, 4–4·5 mm. longa. *Antherae* 2, 2 mm. longae.

Angola : Benguella ; country of the Ambuellas and Ganguellas, *Gossweiler* 2458, 2458A(type), 2659.

Loudetia Thomasii *C. E. Hubbard*, sp. nov. ; affinis *L. arundinaceae* Steud., sed culmis gracilibus 2-nodibus brevioribus, foliorum laminis angustioribus, spiculis et aristis brevioribus differt.

Gramen perenne, dense caespitosum. *Culmi* erecti, usque ad 90 cm. longi, graciles, rigidi, simplices, 2-nodes, glabri laevesque. *Foliorum vaginae* inferiores persistentes, superne pilis e tuberculis ortis laxe hirsutae, superiores glabrae laevesque ; ligulae ad seriem ciliorum densorum redactae ; laminae anguste lineares, basin versus angustatae, in apicem tenuiter acutum attenuatae, usque ad 30 cm. longae, 3–5 mm. latae, planae, firmae, glabrae, subtus scaberulae, supra laeves. *Panicula* angusta, usque ad 35 cm. longa, laxa ; rhachis superne scaberula ; rami fasciculati, gracillimi, scaberuli, usque ad 9 cm. longi ; pedicelli inaequales, laterales usque ad 1 mm., terminales 2–4 mm. longi. *Spiculae* lanceolatae vel anguste oblongae, 6·5–7 mm. longae, brunneae. *Glumae* firme chartaceae, trinerves, pilis albis appressis e tuberculis minutis ortis sparse setulosae ; inferior late ovato-oblonga, apice truncata vel rotundata, 2–3 mm. longa ; superior lanceolata, acuminata, apice truncata, spicula paullo brevior. *Anthoecium inferum* ♂ : lemma glumae superiori simile, sed obtusum, spiculae aequilongum, glabrum ; palea linearis, 5mm. longa. *Anthoecium superum* lineare : callus truncatus, 0·4 mm. longus, minute barbatus ; lemma 4 mm. longum, acute bilobum, lobis circiter 0·5 mm. longis, tenuiter coriaceum, pubescens, 7-nerve ; arista geniculata, 8–16 mm. longa, columna 4–7 mm. longa minute scaberula brunnea ; palea linearis, lemmati aequilonga. *Antherae* 2, 1·5 mm. longae.

UGANDA: Toro District; Kyegegwa, on granite outcrop, dominant grass on deeper soil, 1260 m., *Thomas* 1027.

Loudetia phragmitoides (*Peter*) *C. E. Hubbard*, comb. nov. *Trichopteryx phragmitoides* Peter in Fedde, Repert. Beih. **40**, 1, Anhang, 96 (1930).

Distrib. French Guinea to Sudan and southwards to Angola and Portuguese East Africa.

It has not been possible to examine the specimen on which *Trichopteryx phragmitoides* was based. There is little doubt, however, that it represents the same species as the African plant which has been commonly identified with the tropical South American species *T. flammida* (Trin.) Benth. It differs from the latter in having a usually hairy upper glume, a sterile lower floret and more especially in the shape of the awn, which is shorter and differentiated into a well-marked column and bristle, whereas in *T. flammida* the awn has no definite column and at maturity is bent at a right angle from the apex of the floret.

Loudetia coarctata (*A. Camus*) *C. E. Hubbard*, comb. nov. *Tristachya coarctata* A. Camus in Bull. Soc. Bot. France, **80**, 774 (1933).

Distrib. French Guinea.

Loudetia densispica (*Rendle*) *C. E. Hubbard*, comb. nov. *Trichopteryx densispica* Rendle in Cat. Afr. Pl. Welw. **2**, 214 (1899).

Distrib. Angola.

Loudetia Vanderystii (*De Wild.*) *C. E. Hubbard*, comb. nov. *Trichopteryx Vanderystii* De Wild. in Ann. Soc. Sci. Brux. **39**, Mém. 160: 1920 (Notes Fl. Katanga, **5**, 38).

Distrib. Belgian Congo.

Loudetia pennata (*Chiov.*) *C. E. Hubbard*, comb. nov. *Trichopteryx pennata* Chiov. in Ann. Istit. Bot. Roma, **7**, 69, t. 6 (1897).

Distrib. Abyssinia.

Loudetia Gossweileri *C. E. Hubbard*, sp. nov.; affinis *L. coarctatae* (A. Camus) C. E. Hubbard, sed glumis glabris laevibus, spiculis majoribus, anthoecii superi callo pungente longiore differt.

Gramen perenne, dense caespitosum; innovationes intravaginales. *Culmi* erecti, 75–105 cm. alti, graciliusculi, teretes, rigidi, subglauci, simplices, obscure 2–3-nodes, glabri laevesque. *Foliorum vaginae* basales persistentes, basin culmorum dense obtegentes, dense pilosae vel glabrae, intermediae et superiores internodiis multo breviores, nodos versus flavidae, arcte appressae, superne praecipue prope margines pilosae vel glabrae laevesque; ligulae ad seriem ciliorum brevium redactae; laminae anguste lineares, tenuiter acutae, usque ad 30 cm. longae, 1–2·5 mm. latae, planae vel siccitate involutae, rigidae, erectae, supra arcte nervosae et pubescentes, subtus glabrae

laevesque. *Panicula* spiciformis, densa, 2·5–15 cm. longa, 6–8 mm. lata (aristis exclusis) ; rhachis minutissime pubescens vel asperula ; rami appressi, usque ad 6 mm. longi, 4–1-spiculati, minute pubescentes vel asperuli ; pedicelli laterales brevissimi. *Spiculae* anguste lanceolatae, acuminatae, 15–18 mm. longae, pallide flavido-brunneae. *Glumae* chartaceae, trinerves, glabrae, apicem versus nervis minute scaberulae ; inferior anguste lanceolata, acute acuminata, 12–13 mm. longa ; superior lineari-lanceolata, acute acuminata, spiculae subaequilonga. *Anthoecium inferum* ♂ : lemma glumae superiori simile sed anguste lanceolatum, acuminatum, apice setaceo-acutum ; palea lineari-lanceolata, bifida, 9·5 mm. longa, supra medium carinis minute ciliolata. *Anthoecium superum* lineare : callus pungens, 1–1·5 mm. longus, dense barbatus ; lemma 5–5·5 mm. longum, minutissime bilobum, tenuiter coriaceum, 7-nerve, appresse pubescens ; arista flexuosa, usque ad 7 cm. longa, columna 9–11 mm. longa pubescente ; palea lemmati aequilonga. *Antherae* 2, 3·5–4 mm. longae.

Angola : Benguella ; country of the Ganguellas and Ambuellas, *Gossweiler* 2734, 3760.

Loudetia acuminata (*Stapf*) *C. E. Hubbard*, comb. nov. *Trichopteryx acuminata* Stapf in Kew Bull. 1897, 297.

Distrib. Northern Nigeria and Cameroons.

Loudetia flavida (*Stapf*) *C. E. Hubbard*, comb. nov. *Trichopteryx flavida* Stapf in Kew Bull. 1897, 298.

Distrib. Tanganyika Territory southwards to Transvaal.

Loudetia migiurtina (*Chiov.*) *C. E. Hubbard*, comb. nov. *Trichopteryx migiurtina* Chiov. Pl. Nov. Aethiop. 30 (1928).

Distrib. Italian Somaliland.

Loudetia lanata (*Stent et Rattray*) *C. E. Hubbard*, comb. nov. *Trichopteryx lanata* Stent et Rattray in Proc. Rhod. Sci. Assoc. **33,** 39 (1933).

Distrib. Angola and Southern Rhodesia.

Loudetia Demeusei (*De Wild.*) *C. E. Hubbard*, comb. nov. *Trichopteryx Demeusei* De Wild. in Ann. Soc. Sci. Brux. **39,** Mém. 149 : 1920 (Notes Fl. Katanga, **5,** 27).

Distrib. Belgian Congo and Angola.

Loudetia cerata (*Stapf*) *C. E. Hubbard*, comb. nov. *Trichopteryx cerata* Stapf in Bull. Soc. Bot. France, 1911, **58,** Mém. **8,** 220 (1912).

Distrib. Central Shari and Upper Oubangui.

Loudetia annua (*Stapf*) *C. E. Hubbard*, comb. nov. *Trichopteryx annua* Stapf in Kew Bull. 1897, 298.

Distrib. Northern Nigeria, Cameroons and Sudan.

Loudetia longipes *C. E. Hubbard*, sp. nov. ; affinis *L. lanatae* (Stent et Rattray) C. E. Hubbard, sed spiculis paullo longioribus, glumis glabris, foliorum laminis supra laxe pilosis demum glabris, culmis altioribus 2-nodibus differt.

Gramen perenne caespitosum. *Culmi* erecti, 90–140 cm. alti, teretes, rigidi, validiusculi, simplices, 2-nodes, nodo infero prope basin jacente, nodo supero prominente, glabri laevesque, internodio supremo (pedunculo) usque ad 75 cm. longo. *Foliorum vaginae* nodis dense barbatae, inferiores basi tomentosae in fibras demum fissae et basin culmorum dense obtegentes, ceterae glabrae laevesque ; ligulae ad seriem ciliorum densorum redactae ; laminae anguste lineares, tenuiter acutae, usque ad 40 cm. (vel ultra) longae, convolutae, usque ad 6 mm. latae (explanatae), rigidae, supra laxe pilosae demum glabrae laevesque. *Panicula* laxissima, 22–32 cm. longa, 12–15 cm. lata ; rhachis inferne laevis, apicem versus minute scaberula ; rami patentes, filiformes, minutes scaberuli, sparse divisi, usque ad 14 cm. longi, basi pilosi, superiores solitarii, ceteri 2–4-nati ; pedicelli valde inaequales, laterales usque ad 14 mm. longi, terminales 10–26 mm. longi. *Spiculae* anguste lanceolatae vel oblongo-lineares, 13–14 mm. longae, pallide brunneae. *Glumae* coriaceae, trinerves, glabrae ; inferior oblongo-ovata, truncata vel obtusissima, 5–6·5 mm. longa ; superior lineari-lanceolata, apice truncata, spiculae aequilonga. *Anthoecium inferum* ♂ : lemma lanceolatum, apice obtusum, 10–11 mm. longum, trinerve, glabrum ; palea linearis, truncata, 7–7·5 mm. longa. *Anthoecium superum* lineare : callus pungens, 2 mm. longus, barbatus ; lemma 6–7 mm. longum, minute et acute bilobum, coriaceum, 7-nerve, pubescens ; arista geniculata, 5–6·3 cm. longa, columna minute pubescente 7 mm. longa ; palea 6·5 mm. longa.

Angola : Benguella ; country of the Ganguellas and Ambuellas, *Gossweiler* 4033.

Loudetia crassipes *C. E. Hubbard*, sp. nov. ; affinis *L. Demeusei* (De Wild.) C. E. Hubbard, sed glumis glabris, panicula et aristis brevioribus differt.

Gramen perenne caespitosum. *Culmi* erecti vel leviter geniculati, usque ad 90 cm. alti, graciles, simplices, 2-nodes, glabri laevesque. *Foliorum vaginae* inferiores basi lanatae, superne glabrae, in fibras demum fissae et basin culmorum dense obtegentes, ceterae nodis breviter barbatis exceptis glabrae laevesque, internodiis multo breviores ; ligulae ad seriem ciliorum redactae ; laminae lineares, in acumen tenue attenuatae, usque ad 22 cm. longae, 2–3 mm. latae, planae vel convolutae, firmae, glabrae, subtus laeves et virides, supra purpureae et prominenter nervosae, marginibus scaberulae. *Panicula* contracta, densa, 10–18 cm. longa, usque ad 2 cm. lata ; rhachis laevis ; rami binati vel solitarii, erecti, gracillimi, minute scaberuli, inferiores usque ad 3·8 cm. longi ; pedicelli inaequales, laterales usque ad 2·5 mm. longi, terminales usque ad 6 mm. longi. *Spiculae* anguste lanceolatae, 10–12 mm. longae,

brunneae. *Glumae* chartaceae, glabrae, trinerves ; inferior anguste oblongo-ovata, obtusa, 6 mm. longa ; superior lineari-lanceolata, apice truncata, spiculae aequilonga. *Anthoecium inferum* ♂(?) : lemma glumae superiori simile, lanceolatum, subacutum ; palea linearis, 8 mm. longa. *Anthoecium superum* lineare : callus pungens, usque ad 1·5 mm. longus, barbatus ; lemma 5–6 mm. longum, bilobum, lobis acutissimis circiter 0·6 mm. longis, tenuiter coriaceum, 7-nerve, minute pubescens ; arista geniculata, gracillima, usque ad 5 cm. longa, columna minute pubescente 9–10 mm. longa ; palea lemmati aequilonga.

ANGOLA : Benguella ; country of the Ganguellas and Ambuellas, *Gossweiler* !

Loudetia hordeiformis (*Stapf*) *C. E. Hubbard*, comb. nov. *Trichopteryx hordeiformis* Stapf in Kew Bull. 1897, 297.

Distrib. Gambia, French Sudan, Ivory Coast, Gold Coast, Northern Nigeria, Central and Lower Shari.

Loudetia camerunensis (*Stapf*) *C. E. Hubbard*, comb. nov. *Trichopteryx camerunensis* Stapf in Kew Bull. 1897, 296.

Distrib. Cameroons Mtn.

Loudetia simplex (*Nees*) *C. E. Hubbard*, comb. nov. *Tristachya simplex* Nees, Fl. Afr. Austr. 269 (1841).

Distrib. French Guinea, Northern Nigeria and Sudan, southwards to Transvaal, Natal and Orange Free State.

Loudetia ternata (*Stapf*) *C. E. Hubbard*, comb. nov. *Trichopteryx ternata* Stapf in Morot, Journ. de Bot. **19**, 106 (1905).

Distrib. French Guinea and Dahomey.

Loudetia ambiens (*K. Schum.*) *C. E. Hubbard*, comb. nov. *Trichopteryx ambiens* K. Schum. in Engl. Bot. Jahrb. **24**, 335 (1897).

Distrib. Ivory Coast, Dahomey, Northern Nigeria and Portuguese Congo.

Loudetia glabrata (*K. Schum.*) *C. E. Hubbard*, comb. nov. *Trichopteryx glabrata* K. Schum. in Engl. Bot. Jahrb. **24**, 336 (1897), in obs.

Distrib. Gold Coast and Cameroons.

Loudetia Bequaertii (*De Wild.*) *C. E. Hubbard*, comb. nov. *Trichopteryx Bequaertii* De Wild. in Ann. Soc. Sci. Brux. **39**, Mém. 146 (1920).

Distrib. Tanganyika Territory, Belgian Congo and Northern Rhodesia.

Loudetia togoënsis (*Pilger*) *C. E. Hubbard*, comb. nov. *Trichopteryx togoënsis* Pilger in Engl. Bot. Jahrb. **34**, 128 (1904).

Distrib. French Guinea, French Sudan and Central Shari.

Loudetia capillipes *C. E. Hubbard*, sp. nov. ; affinis *L. ambienti* (K. Schum.) C. E. Hubbard, sed panicula breviore flexuosa laxa, rhachi et ramis pilosis vel villosis, culmis gracilibus, foliorum laminis subsetaceis brevioribus et angustioribus differt.

Gramen perenne caespitosum. *Culmi* erecti, usque ad 75 cm. alti, graciles, simplices, 1–2-nodes, paniculam nodosque versus pilosi vel glabri laevesque. *Foliorum vaginae* internodiis breviores, arcte appressae, laeves, inferiores basi villosae, superne sparse hirsutae vel glabrae, ceterae glabrae ; ligulae ad seriem ciliorum minutorum redactae ; laminae subsetaceae, tenuiter acutae, erectae, usque ad 20 cm. longae, involutae, usque ad 1 mm. latae (explanatae), flexuosae, firmae, laxe hispidulae vel glabrescentes. *Panicula* laxa; ovata vel oblonga, 7–18 cm. longa ; rhachis flexuosa, gracillima ; rhachis et rami pilis mollibus patentibus albis e tuberculis minutis ortis pilosi vel villosi, plerumque purpurei ; rami capillares, valde flexuosi, plerumque simplices, inferiores 2–5-nati, usque ad 4·5 cm. longi ; pedicelli 1·5–4 mm. longi, ut ramis villosi. *Spiculae* apice ramorum per triades fasciculatae, lanceolatae vel oblongae et hiantes, 6–7·5 mm. longae, brunneae. *Glumae* tenuiter chartaceae, trinerves ; inferior lanceolata, acuta, 4–5 mm. longa, marginibus et nervis lateralibus pilis patentibus albis usque ad 4 mm. longis e tuberculis ortis hirsuta ; superior lanceolata, acuminata, apice truncata vel obtusa, spiculae aequilonga, marginibus ciliata. *Anthoecium inferum* ♂ : lemma oblongo-lanceolatum, truncatum vel obtusum, gluma superiore paullo brevius, trinerve, apice ciliolatum ; palea linearis, 5–6 mm. longa, carinis minute ciliolata. *Anthoecium superum* lineare : callus emarginatus, circiter 0·6 mm. longus, villosus ; lemma 3–3·5 mm. longum, acute bilobum, lobis usque ad 1 mm. longis, tenuiter coriaceum, 7-nerve, breviter pubescens ; arista flexuosa, 2·5–2·8 cm. longa, columna 10–13 mm. longa minute pubescente ; palea linearis, 3·5–4 mm. longa. *Antherae* 2, 1·5–2·5 mm. longae.

French Guinea : Timbo, on marshy rocky ground, *Pobéguin* 1757.

Loudetia trigemina *C. E. Hubbard*, sp. nov. ; affinis *L. capillipedi* C. E. Hubbard, sed rhachi et ramis glabris vel fere glabris, culmis 4-nodibus, gluma inferiore spiculae paullo breviore, lemmati inferiore 7-nervi differt.

Gramen perenne. *Culmi* erecti vel basi geniculati, usque ad 1 m. alti, graciles, simplices, 4-nodes, nodos inferiores versus pilis brevibus hirsuti, ceteri glabri laevesque. *Foliorum vaginae* internodiis breviores, inferiores basi villosae, ceterae (summa excepta) superne molliter pilosae vel glabrescentes, nodis glabrae ; ligulae ad seriem ciliorum minutorum redactae ; laminae lineares, tenuiter acutae, usque ad 30 cm. longae et 3 mm. latae, planae vel siccitate convolutae, pilis brevibus e tuberculis minutis ortis pilosae vel glabrescentes vel glabrae laevesque. *Panicula* laxa, 8·5–10 cm. longa ; rhachis gracillima, nodo infimo minute villosa, ceterum

glabra, laevis; rami tenuiter filiformes, asperuli, sparse divisi, inferiores 2–4-nati, usque ad 3·8 cm. longi; pedicelli inaequales, usque ad 1·5 mm. longi, apicem versus pilis rigidis albis praediti. *Spiculae* apice ramorum per triades fasciculatae, lanceolatae vel lanceolato-oblongae, 6–6·5 mm. longae. *Glumae* chartaceae, lanceolatae; inferior truncata, superiore paullo brevior, trinervis, minutissime hispidula, nervis lateralibus pilis rigidis albis e tuberculis ortis praedita; superior acuminata, truncata, spiculae aequilonga, 3–5-nervis, asperula, infra medium ad margines pilis brevibus paucis e tuberculis ortis praedita. *Anthoecium inferum* ♂(?): lemma lanceolatum, obtusum, 5 mm. longum, membranaceum, 7-nerve, asperulum; palea lineari-oblonga, 3·5–4 mm. longa, carinis ciliolata. *Anthoecium superum* lanceolato-lineare: callus truncatus, 0·4 mm. longus, longe barbatus; lemma 2·5 mm. longum, bilobum, lobis lanceolatis acutis circiter 1·8 mm. longis, tenuiter coriaceum, 5–7-nerve, pubescens; arista geniculata, usque ad 1·8 cm. longa, columna scabrida 5–6 mm. longa; palea 3–3·5 mm. longa, carinis ciliolata. *Caryopsis* 2 mm. longa.

NORTHERN NIGERIA: Wana, in crevices on granite rocks, *Hepburn*.

Loudetia eriopoda *C. E. Hubbard*, sp. nov.; affinis *L. simplici* (Nees) C. E. Hubbard, sed spiculis paullo brevioribus, anthoecii superi callo truncato vel leviter emarginato, aristis et antheris brevioribus differt.

Gramen perenne. *Culmi* erecti, circiter 90 cm. alti, graciles, teretes, simplices, 2-nodes, basin versus hirsuti vel glabri laevesque. *Foliorum vaginae* pilis e tuberculis ortis plus minusve hispidae, nodis barbatae, inferiores basi dense villosae vel lanatae, demum in fibras fissae et basin culmi dense obtegentes; ligulae ad seriem ciliorum brevium redactae; laminae lineares, tenuiter acutae, 18 cm. (vel ultra) longae, 5 mm. latae, planae, ut vaginae hirsutae. *Panicula* ovata, laxa, 22 cm. longa, 7·5 cm. lata; rhachis inferne laevis, superne minute scaberula; rami laxe divisi, fasciculati, tenuiter filiformes, scaberuli, inferiores usque ad 9 cm. longi; pedicelli inaequales, usque ad 6 mm. longi. *Spiculae* lineari-lanceolatae et acuminatae vel lineari-oblongae, 7–8 mm. longae, rubro-brunneae. *Glumae* chartaceae, trinerves, glabrae; inferior oblongo-ovata, truncata vel obtusissima, 3–3·5 mm. longa; superior lineari-lanceolata, truncata, spiculae aequilonga. *Anthoecium inferum* ♂: lemma lanceolatum, acuminatum, apice obtusum, usque ad 7·5 mm. longum, glabrum, trinerve; palea linearis, truncata, 5 mm. longa, supra medium carinis minute ciliolata. *Anthoecium superum* lineare: callus truncatus vel leviter emarginatus, 0·5 mm. longus, dense barbatus; lemma 3·5–4 mm. longum, minute et acute bilobum, tenuiter coriaceum, 7-nerve, minute pubescens; arista geniculata, 2·5—3·2 cm. longa, columna usque ad 8 mm. longa minute pubescente; palea anguste linearis, 4·5 mm. longa. *Antherae* 2, 1·5 mm. longae.

CAMEROONS: Tibati Highland; Assum, *Tessmann* 2728.

Tristachya fulva *C. E. Hubbard*, sp. nov. ; affinis *T. chrysothrici* Nees, sed spiculis et aristis brevioribus, panicula laxiore differt.

Gramen perenne. *Culmi* erecti, usque ad 1·2 m. alti, graciles, simplices, rigidi, 2-nodes, pilosi vel glabri laevesque ; internodia longe exserta, summa usque ad 60 cm. longa. *Foliorum vaginae* arcte appressae, hispidae vel marginibus pilis e tuberculis minutis ortis ciliatae, nodis pilis flavidis usque ad 8 mm. longis dense barbatae; ligulae ad seriem ciliorum minutorum redactae ; laminae anguste lineares, setaceo-acutae, usque ad 35 cm. longae, convolutae vel explanatae et usque ad 2·5 mm. latae, rigidae, supra laxe pilosae, subtus hispidulae. *Panicula* laxa, 12–20 cm. longa, 13–38 triades spicularum gerens ; rhachis gracilis, flexuosa, scabrida vel scaberula, nodo infero breviter villosa ; rami filiformes, sparse divisi vel simplices, scabridi, apicem versus flexuosi et pilis fulvis vel aureis patentibus e tuberculis minutis ortis setosi, inferiores 2–3-nati, usque ad 4·5 cm. longi ; pedicelli 1–2 mm. longi, ut rami setosi. *Spiculae* lanceolatae, 11–17 mm. longae, aureo-brunneae. *Gluma inferior* anguste lanceolata, setaceo-acuminata, 7–13 mm. longa, rigida, trinervis, nervis lateralibus pilis rigidis patentibus fulvis usque ad 3·5 mm. longis e tuberculis brunneis ortis dense setosa, apice scabrida ; gluma superior lineari-lanceolata, acuminata, truncata, spiculae aequilonga, trinervis, chartacea, supra medium margines versus pilis brevibus e tuberculis ortis hispidula. *Anthoecium inferum* ♂ : lemma lanceolatum, acuminatum, apice acutum, 10–12 mm. longum, 3-nerve, glabrum vel circa medium minute hirsutum ; palea linearis, 8–9 mm. longa, carinis minute ciliolatis. *Anthoecium superum* lineare : callus oblique truncatus vel emarginatus, 0·6–1 mm. longus ; lemma 4·5–5 mm. longum, lobis acutis angustis 1 mm. longis bilobum, tenuiter coriaceum, 7-nerve, dense pubescens ; arista 3·8–5 cm. longa, columna scabrida 1·4–2 cm. longa ; palea 5–6 mm. longa. *Antherae* 2, 4 mm. longae. *Ovarium* glabrum.

French Guinea : Timbo, on dry ground, *Pobéguin* 1758.

Tristachya Welwitschii *Rendle* var. **superbiens** (*Pilger*) *C. E. Hubbard*, var. nov. *T. superbiens* Pilger in Engl. Bot. Jahrb. **40,** 82 (1907).

Distrib. Angola.

Tristachya Welwitschii *Rendle* var. **major** *C. E. Hubbard*, var. nov ; affinis var. *superbienti* C. E. Hubbard, sed culmis 1·8–2·4m. altis pruinosis, foliorum laminis 9–14 mm. latis glaucis glabris, panicula 28 cm. longa circiter 45 triades spicularum gerente.

Southern Rhodesia : Salisbury, 1140 m., *Eyles* 3403.

Tristachya Rehmannii *Hack.* var. **Helenae** (*Buscal. et Muschl.*) *C. E. Hubbard*, var. nov. *T. Helenae* Buscal. et Muschl. in Engl. Bot. Jahrb. **49,** 458 (1913).

Distrib. Nyasaland, Northern and Southern Rhodesia.

Tristachya Rehmannii Hack. appears to be confined to the Transvaal, where it is widely distributed. It differs from var. *Helenae* in having scaberulous culms, finely grooved leaf-sheaths which are scaberulous in the grooves and minutely villous at the nodes, a relatively shorter lower glume, a longer palea to the lower floret (up to 2 cm. long), on the average longer awns (6·3-8·8 cm.) and columns (1·8–4 cm. long).

Tristachya Rehmannii *Hack.* var. **pilosa** *C. E. Hubbard,* var. nov. ; a typo differt culmis pilosis (internodio superiore excepto), nodis dense sericeo-villosis, aristis brevioribus.

ANGOLA : Benguella ; country of the Ganguellas and Ambuellas, *Gossweiler* 2455.

Tristachya Kerstingii *C. E. Hubbard,* comb. nov. *Trichopteryx Kerstingii* Pilger in Engl. Bot. Jahrb. **34,** 128 (1904).

Distrib. Dahomey and Northern Nigeria.

Danthoniopsis barbata (*Nees*) *C. E. Hubbard,* comb. nov. *Tristachya barbata* Nees, Fl. Afr. Austr. 269 (1841). *T. somalensis* Franch. in Révoil, Çomali, 67 : 1882 (Sertulum Somalense). *Sorghum barbatum* Steud. et Hochst. ex Steud. Nomencl. Bot. ed. 2, 612 (1841), in syn. *Loudetia barbata* A. Br. ex Steud. Syn. Pl. Glum. **1,** 238 (1854), in syn. *Trichopteryx somalensis* Engl. in Abh. Preuss. Akad. Wiss. 1891, **2,** 130 (1892). *T. barbata* Hack. ex Durand et Schinz, Consp. Fl. Afr. **5,** 846 (1894).

Distrib.—Sudan, Eritrea, Somaliland and Tropical Arabia (Yemen).

It is very probable that *Tristachya Bricchettiana* Chiov. in Ann. Istit. Bot. Roma, **6,** 162, t.14 (1897) should be referred to this species. The type-specimen in the Florence Herbarium consists of two small pieces of rootstock and culm, and a packet containing immature inflorescences. According to Chiovenda it differs from *Tristachya barbata* Nees in having pubescent glumes and a glabrous membranous upper lemma ; in other respects it is similar to that species. The spikelets are, however, far too young and too badly preserved to ascertain the structure of the upper lemma. The fertile florets are full of fungal hyphae and the lemma and palea in a state of disintegration. It is true that the lemma is membranous but this is always the case in young material of the species. Lateral beards may also be present on the lemma as the hairs when young remain matted together and superficially resemble a piece of tissue ; they would then be difficult to recognise in a decomposing floret.

Tristachya Stocksii Boiss. Fl. Orient. **5,** 552 (1884), from Sind and Baluchistan, was reduced to a synonym of *Tristachya barbata* Nees by Hooker (Fl. Brit. Ind. **7,** 272). It appears to me to be a distinct species differing from the latter by the shorter truncate long-bearded callus of the fertile floret, the almost continuous transverse longer beard of the upper lemma and the more slender and shorter awns.

Danthoniopsis Dinteri (*Pilger*) *C. E. Hubbard*, comb. nov. *Trichopteryx Dinteri* Pilger in Engl. Bot. Jahrb. **51**, 414 (1914).

Distrib. Angola, South West Africa, Northern Transvaal.

Danthoniopsis pruinosa *C. E. Hubbard*, sp. nov.; affinis *D. minori* Stapf et C. E. Hubbard, sed culmis erectis vel geniculato-ascendentibus 5–multi-nodibus pruinosis lignosis, rhachi asperula, spiculis minoribus flavido-brunneis vel pallide brunneis, lemmate inferiore trinervi differt.

Gramen perenne; innovationes extravaginales. *Culmi* erecti vel geniculato-ascendentes, usque ad 1·2 m. (vel ultra) alti, teretes, lignosi, nodos versus pruinosi, 5-multi-nodes, simplices vel ramosi, paniculam versus minute pubescentes vel glabri laevesque. *Foliorum vaginae* latae, laxae, internodiis longiores, basales sericeo-pilosae, ceterae glabrae vel pilis e tuberculis ortis laxe pilosae; ligulae ad seriem ciliorum densorum redactae; laminae lineares, basi contractae, in apicem setaceum attenuatae, usque ad 23 cm. longae, 4–11 mm. latae, planae, glaucae, glabrae vel pubescentes, nervis et marginibus asperulae. *Panicula* linearis vel anguste oblonga, contracta et densa, usque ad 25 cm. longa, 1·2–3·8 cm. lata; rhachis teres, superne asperula; rami geminati vel semi-verticillati, filiformes, glabri, scaberuli, divisi, inferiores usque ad 6.5 cm. longi; pedicelli 1·5–5 mm. longi. *Spiculae* lanceolatae vel anguste oblongae, 5–7 mm. longae, flavido-brunneae vel pallide brunneae. *Glumae* chartaceae, glabrae, trinerves, nervis scaberulae; inferior ovata vel elliptico-ovata, acuta, mucronata, 3·5–5 mm. longa; superior anguste ovata vel elliptico-ovata, acuta, spicula paullo brevior. *Anthoecium inferum* ♂: lemma lanceolato-oblongum, obtusum, mucronatum, 4·5–6·5 mm. longum, membranaceum, trinerve, glabrum; palea linearis, obtusa, 4–4·5 mm. longa, carinis superne ciliolata. *Anthoecium superum* lineare: callus truncatus, 0·5 mm. longus, dense barbatus; lemma 3·5 mm. longum, bilobum, lobis acutissimis 2 mm. longis, tenuiter coriaceum, 5-nerve, appresse pilosum, infra quemque lobum fasciculis pilorum longorum tribus transverse barbatum; arista geniculata, 8–12 mm. longa, columna brunnea 3–4 mm. longa fere laevi; palea linearis, 4·5 mm. longa, carinis anguste alatis. *Antherae* 3, lineares, 2–3 mm. longae.

Northern Rhodesia: Pemba, on hills of gneissic granite, 1200 m., *Trapnell* 997 (type).

Southern Rhodesia: Marandellas, *S. Rhod. Govt. Herb.* 3008; Matopo Hills, 1350 m., *Rogers* 5194, 7944, *Hitchcock* 24256.

Brachyachne chrysolepis *C. E. Hubbard*, sp. nov.; affinis *B. patentiflorae* (Stent et Rattray) C. E. Hubbard, sed culmis nonnunquam ramosis, spica et spiculis longioribus, glumis latioribus, lemmate breviter mucronato differt.

Gramen perenne, dense caespitosum, usque ad 33 cm. altum. *Culmi* erecti vel leviter geniculati, gracillimi, teretes, 2–3-nodes, simplices vel e nodo infimo ramosi, glabri laevesque. *Foliorum*

vaginae plerumque basales ; vaginae internodiis breviores, arcte appressae, glabrae laevesque, basales purpureae ; ligulae brevissimae, truncatae ; laminae angustissime lineares, apice subpungentes, usque ad 12 cm. longae et 1 mm. latae, planae vel siccitate convolutae, supra minute asperulae et pilis debilibus paucis praeditae, subtus glabrae laevesque. *Spica* solitaria, erecta, stricta, gracilis, usque ad 9 cm. longa, aureo-flava ; rhachis laevis, 0·8–1 mm. lata. *Spiculae* oblanceolato-oblongae, demum leviter hiantes, 4–4·5 mm. longae. *Glumae* carinatae, uninerves, anguste oblongae vel anguste lanceolato-oblongae, obtusae ; inferior carina scaberula ; superior carina angustissime alata, laevis. *Lemma* explanatum late elliptico-oblongum, obtusissimum vel fere truncatum, breviter mucronatum, 3 mm. longum, tenuiter membranaceum, nervis dense ciliatum ; palea lemmati subaequilonga, carinis ciliolata. *Rhachilla* usque ad 2 mm. ultra anthoecium producta.

Uganda : Bugishu ; Buligenye, in cracks in rocks, 1380 m., *Thomas* 376.

LIII—ON THE FLORA OF THE NEARER EAST XV*.

A Contribution to the Flora of Central Albania, D. A. Chaytor and W. B. Turrill.

Since the war there has been an increasing interest taken in the flora of the Balkan Peninsula. Many parts of this large area, however, still remain either untouched botanically or merely skimmed by passing travellers. Resident collectors and investigators have facilities, with which the traveller cannot compete, for adding to our botanical knowledge. Central Albania has been largely neglected botanically even by travellers, with the notable exception of Dr. Fr. Markgraf of Berlin-Dahlem. The following contribution is based on a first collection by Mrs. R. V. Pennington who resides in the Tiranë (Tirana) district. A considerable number of additions to Dr. Markgraf 's list (Fedde, Repert. Beih. **45**, 1927) are recorded, a fair number of species new to Albania, and one species (*Helianthemum jonium* Lacaita et Grosser) new to the Balkan Peninsula.

The sequence followed for the families is that of Bentham and Hooker's Genera Plantarum ; the genera and species are placed alphabetically within each family.

Ranunculus sardous Cr. Durazzo, on very poor grass land near sandy shore, 12.5.34, No. 9.

Ranunculus sardous Cr. var. *subglaber* Koch. Durazzo, on sandy dunes, near sea level, 13.5.34, No. 22.

Thalictrum aquilegifolium L. Dajti, meadow in limestone hills, 1220 m., 26.5.34, No. 42.

Aethionema saxtile R. Br. Limestone slope leading to peak of Dajti, 1070 m., 27.5.34, No. 101.

* Continued from Kew Bull. 1933, 240.

Alyssum alyssoides L. Dajti and Tiranë hills, among rocks, 920 m., 28.5.34, No. 77.

Allyssum repens Baumg. The material is too young to determine the subspecies or variety. Dajti, meadows in limestone hills, 1220 m., 26.5.34, No. 28. Limestone slope leading to peak of Dajti, 1070 m., 27.5.34, No. 117.

Arabis hirsuta (L.) Scop. Limestone slope leading to peak of Dajti, 1070 m., 27.5.34, No. 104, No. 116.

Erysimum pusillum Ch. et B. Dajti above Tiranë, 1670 m., 27.5.34, No. 90.

Rapistrum hispanicum (L.) Cr. Durazzo, 77 m., 7.5.34, on slope of hill by road-side, No. 2.

Thlaspi ochroleucrum Boiss. et Heldr. Limestone slope leading to peak of Dajti, 1070 m., 27.5.34, No. 112.

Reseda Luteola L. Durazzo, on slope of hill by road-side outside the town, 77m., 7.5.34, No. 1.

Cistus villosus L. Near Dajti and Tiranë hills, limestone rocks, 28.5.34, No. 65.

Fumana vulgaris Spach. Dajti above Tiranë, 27.5.34, No. 96.

Helianthemum jonium Lacaita et Grosser var. *psilosepalum* Gross. et Lac. Flor. Ital. exicc. 1277 (in Herb. Kew pro parte) et in Nuov. Giorn. Bot. Ital. xvii, 609 (1910). Near Durazzo, 13.5.34, on sandy dunes with thin layer of vegetable mould, near sea level, No. 18. The discovery of this plant on the Albanian side of the Adriatic adds another species to the flora of the Balkan Peninsula. Previously, so far as is known, it has only been found in South Italy in the neighbourhood of Taranto.

Helianthemum nummularium (L.) Mill. Near Dajti and Tiranë hills, limestone rocks, 920 m., 28.5.34, No. 66.

Viola gracilis S. et S. sensu Becker. Dajti, meadow in limestone hills, 1220 m., 26.5.34, No. 35.

Polygala nicaeensis Risso. subsp. *mediterranea* Chod. Dajti, meadow in limestone hills, 1220 m., 26.5.34, Nos. 43, 44, 45.

Cerastium brachypetalum Desp. var. *glandulosum* Koch. Dajti, meadow in limestone hills, 1220 m., 26.5.34, No. 32.

Cerastium litigiosum De Lens. Limestone slope leading to peak of Dajti, 1070 m., 27.5.34, No. 108.

Dianthus cruentus Gris. Dajti and Tiranë hills, among rocks, 920 m., 28.5.34, No. 53.

Moenchia mantica (Torn) Bartl. Dajti and Tiranë hills, in meadow, 920 m., 28.5.34, No. 56.

Saponaria calabrica Guss. Dajti, meadow in limestone hills, 1220 m., 26.5.34, No. 36. Limestone slope leading to peak of Dajti, 1070 m., 27.5.34, No. 102.

Silene cucubalus Wib. Near Dajti and Tiranë hills, in meadow, 28.5.34, No. 73.

Silene italica L. Dajti and Tiranë hills, in meadow, 920 m., 28.5.34, No. 76.

Hypericum perforatum L. var. *angustifolium* (DC.) Gaud. Sand dunes near Durazzo, 10.6.34, No. 135.

Linum angustifolium Huds. Near Dajti and Tiranë hills, in meadows, 920 m., 28.5.34, No. 67. On way down from Dajti to Tirane, 460 m., 28.5.34, No. 129.

Linum capitatum Kit. Near Dajti and Tiranë hills, in meadows, 920 m., 28.5.34, No. 71.

Geranium molle L. Durazzo, on very poor grass land near sandy shore, growing in some scrub, on slope near sea, 12.5.34, No. 10.

Geranium sanguinem L. Limestone slope up to peak of Dajti, 1070 m., 27.5.34, No. 100.

Dorycnium herbaceum Vill. Durazzo, on sandy dunes with thin layer of vegetation mould, near sea level, 13.5.34, No. 15. Dajti above Tiranë, 1670 m., 27.5.34, No. 97. Sand dunes near Durazzo, 10.6.34, No. 136.

Dorycnium hirsutum L. Near Durazzo, on poor grass land near sandy shore, near sea level, 12.5.34, No. 17.

Hymenocarpus circinnatus (L.) Savi. Durazzo, on very poor grass land near sandy shore, slope near sea, 12.5.34, No. 6.

Lotus corniculatus L. Dajti, above Tiranë central Albania, on summit of limestone range. 27.5.34, 1670 m., No. 99.

Medicago marina L. Durazzo, on sandy dunes with thin layer of vegetation mould, near sea level, 13.5.34, No. 16.

Psoralea bituminosa L. Lushnija, May 1934, sine numero.

Trifolium campestre Schreb. Durazzo, on very poor grass-land near sandy shore, slope near sea, 12.5.34, No. 5.

Trifolium Pignantii Fauché et Chaub. Dajti and Tiranë hills, in meadow, 920 m., 28.5.34, No. 62.

Trifolium resupinatum L. Near Durazzo, on sand dunes with thin layer of vegetation mould, near sea-level, 13.5.34, No. 14.

Trigonella corniculata L. Durazzo, near sea level, on sandy dunes, 12.5.34, No. 21.

Agrimonia Eupatoria L. On way down from Dajti to Tiranë, 460 m., 28.5.34, No. 126.

Amelanchier cretica (Willd.) DC. Dajti above Tiranë, 1670 m., 27.5.34, No. 87.

Filipendula hexapetala Gilib. Dajti and Tiranë hills, in meadow, 920 m., 28.5.34, No. 57.

Potentilla hirta L. var. *laeta* Foecke. Dajti, meadow in limestone hills, 1220 m., 26.5.34, No. 31. Dajti and Tiranë hills, in meadow, 920 m., 28.5.34, No. 54.

Rosa spinosissima L. var. *spinosa* (Neilr.) J. B. Kell. Dajti above Tiranë, 1670 m., 27.5.34, No. 83.

Sorbus Aria (L.) Cr. var. *cretica* (Lindl.) Schneid. Dajti above Tiranë, 1670 m., 27.5.34, No. 89.

Saxifraga Grisebachii Deg. et Dörfl. Dajti above Tiranë, 1670 m., 28.5.34, No. 88.

Saxifraga rotundifolia L. var. *hirsuta* Sternb. Dajti, meadow in limestone hills, 1220 m., 26.5.34, No. 39.

Saxifraga rotundifolia L. var. *vulgaris* Engl. Dajti above Tiranë, 1670 m., 27.5.34, No. 94.

Bunuim alpinum W. et K. var. *montanum* (Koch) Burn. sensu Wolff Pflanzenreich iv, 228, 204. (1927). Slope down Dajti range above Tiranë, 610 m., 28.5.34, No. 122.

Cnidium silaifolium (Jacq.) Simk. Limestone slope leading to peak of Dajti, 1070 m., 27.5.34, No. 103.

Oenanthe incrassens Ch. et B. Durazzo, on very poor grass land near sandy shore, slope near sea, 12.5.34, No. 11.

Orlaya grandiflora Hoffm. Near Dajti and Tiranë hills, in meadow, 920 m., 28.5.34, No. 68.

Lonicera alpigena L. subsp. *Formanekiana* (Hal.) Hayek var. *adenophora* Hal. Dajti above Tiranë, 1670 m., 27.5.34, No. 81.

Lonicera caprifolium L. Slopes of Dajti. On pure clay bank washed down by rain, scentless, only found in one spot, 460 m., 28.5.34, No. 49.

Galium Cruciata (L.) Scop. Dajti, meadow in limestone hills, 1220 m., 26.5.34, No. 38. Dajti and Tiranë hills, in meadow, 28.5.34, No. 59.

Galium lucidum All. subsp. *corrudaefolium* (Vill) Hayek. Dajti and Tiranë hills, among rocks, 920 m., 28.5.34, No. 58.

Putoria calabrica (L. f.) DC. Slopes of Dajti on pure clay bank washed down by rain, scentless, only found in one spot, 460 m., 28.5.34, No. 48.

Knautia drymeia Heuff. var. *Nympharum* (Boiss. et Heldr.) Szabó. Dajti above Tiranë, 1670 m., 27.5.34, No. 92.

Knautia integrifolia (L.) Bertol. var. *hybrida* (All.) Szabó. Dajti Range, on way down from Dajti to Tiranë, 460 m., 28.5.34, No. 132.

Scabiosa crenata Cyr. Near Dajti and Tiranë hills, in meadow, 920 m., 28.5.34, No. 72.

Achillea grandifolia Friv. Limestone slope leading to peak of Dajti. 1070 m., 27.5.34, No. 113.

Anthemis montana L.var ? Dajti and Tiranë hills, in meadow, 920 m., 28.5.34, No. 55. Durazzo, on sandy dunes, near sea level, 13.5.34, No. 20.

Carduus nutans L. Dajti above Tiranë, 1670 m., 27.5.34, No. 86.

Centaurea Triumfetti All. Dajti, meadow in limestone hills, 1220 m., 26.5.34, No. 33. Dajti above Tiranë, 1670 m., 27.5.34, No. 82.

Doronicum Columnae Ten. Dajti, meadow in limestone hills, 1220 m., 26.5.34, No. 41.

Leucanthemum vulgare Lam. subsp. *pallens* (Gay) Briqu. On way down from Dajti to Tiranë, 460 m., 28.5.34, No. 130. Sand dunes near Durazzo, 10.6.34, No. 138.

Pallenis spinosa Cass. Durazzo, on grass hillside near ruins, 60 m., 10.5.34, No. 3.

Silybum Marianum (L.) Gaertn. Durazzo, on very poor grass land near sandy shore, slope near sea, 12.5.34, No. 4.

Tragopogon balcanicum Vel. Dajti and Tiranë hills, in meadow, 920 m., 28.5.34, No. 52.

Asyneuma limoniifolium (L.) Janch. Near Dajti and Tiranë hills, in meadow, 920 m., 28.5.34, No. 64.

Campanula lingulata W. et K. Near Dajti and Tiranë hills, 920 m., 28.5.34, No. 74.

Campanula ramosissima S. et S. On way down from Dajti to Tiranë, 460 m., 28.5.34, No. 127.

Vinca major L. var. *pubescens* Urum. in Oesterr. Bot. Zeitschr. **50,** 17 (1900) e descr. On the way to Lushnija, c. 150 m., loose stony soil, May, 1934, No. 128. This is a very interesting plant and while undoubtedly allied to *V. major* L. may prove to be not merely a variety but a distinct species. Urumoff's original description is very meagre ; for example, no measurements are given. The type of the variety came from Mikre on the northern slopes of the Stara Planina (Balkans) in North Bulgaria. Hayek in Denk. Akad. Wiss. Wien Math.-Naturwiss. Kl. **99,** 191 (1924) uses the varietal name for a plant from Kula Lums 250 m., northern Albania, with the words " Die Blüten sind bedeutend kleiner als an der typischen Form." Markgraf, in Fedde Repert. Beih, **45,** 203 (1927) records *V. major* L. from " Arrenwald am Lum i Tiranës, 120 m.," Unfortunately Mrs. Pennington's material is insufficient for us to describe the plant fully and till more is received we propose to use Urumoff 's name with a considerable doubt regarding the true status of the plant.

Vincetoxicum Huteri Vis. et Aschers. Limestone slope leading to peak of Dajti, 27.5.34, No. 114, 1070 m.

Blackstonia perfoliata (L.) Huds. Durazzo, on very poor grass land near sandy shore, slope near sea, No. 8.

Centaurium umbellatum Gilib. Sand-dunes near Durazzo, 10.6.34, No. 134.

Alkanna boeotica DC. Limestone slope leading to peak of Dajti 1070 m., 27.5.34, No. 107.

Alkanna tinctoria (L.) Tsch. Durazzo, on sandy dunes near sea level, colour vivid bright deep blue, 13.5.34, No. 19.

Cynoglossum columnae Ten. Limestone slope leading to peak of Dajti, 1070 m., 27.5.34, No. 105.

Cynoglossum creticum Mill. Near Durazzo, on poor grass land near sandy shore, on slope near sea, 12.5.34, No. 13.

Lycopsis variegata (L.) Lehm. Dajti and Tiranë hills, 920 m., 28.5.34, No. 60.

Moltkia petraea DC. Dajti, growing on limestone rock on steep wall of rock, 1220 m., 26.5.34, No. 46.

Myosotis alpestris Schmidt. Limestone slope leading to peak of Dajti, 1070 m., 27.5.34, No. 110.

Myosotis arvensis (L.) Hill. Dajti, meadow in limestone hills, 1220 m., 26.5.34, No. 30.

Symphytum Leonhardtianum Pugsley in Journ. Bot. **69,** 95

(1931). Dajti, meadow in limestone hills, 1220 m., 26.5.34, No. 37. We are uncertain if this species is really distinct from *S. tuberosum* L. The only character given in the differential diagnosis (l.c. 96) which seems to have much taxonomic value, so far as can be judged from herbarium material, is the shape and size of the calyx-segments and plants showing intermediate conditions of even this character are at Kew.

Calystegia sepium (L.) R. Br. Nr. Tiranë, growing on hedge, 275 m., 28.5.34, No. 50.

Calystegia soldanella R. Br. Near Durazzo, 13.5.34, near sea-level, on sandy dunes, No.23.

Convolvulus elegantissimus Mill. Near Dajti and Tiranë hills, in meadows, 920 m., 28.5.34, No. 70. and No. 75.

Alectorolophus major (Ehrh.) Rchb. Dajti, meadow in limestone hills, 1220 m., 26.5.34, No. 34.

Digitalis lanata Ehrh. On way down from Dajti to Tiranë, 28.5.34, No. 131.

Linaria peloponnesiaca Boiss. et Heldr. On slope above the plain of Musakir near Lushnija, 3 ft. high, 154 m., 14.5.34, No. 24.

Parentucellia viscossa (L.) Cav. Near Durazzo, in the sand dunes along the shore, 10.6.34, No. 139.

Scrophularia canina L. Dajti, on slope down Dajti Range above Tiranë, 620 m., 28.5.34, No. 124.

Veronica austriaca L. subsp. *Jacquinii* (Baum) Maly. Dajti, meadow in limestone hills, 1220 m., 26.5.34, No. 29. Limestone slope leading to peak of Dajti, 1070 m., 27.5.34, No. 109.

Ramondia serbica Panč. Dajti, growing in crevice of rock, only found in two spots and very few plants at either, 1200 m., 26.5.34, No. 47.

Globularia cordifolia L. subsp. *cordifolia* (L.) Hay. Dajti and Tiranë, 1670 m., 27.5.34, No. 80.

Calamintha alpina (L.) Lam. Dajti above Tiranë, 27.5.34, No. 85. Dajti above Tiranë, 1670 m., 27.5.34, No. 98.

Lamium garganicum L. subsp. *garganicum* (Gris.) Briqu. Slope down Dajti range above Tiranë, 620 m., 28.5.34, No. 123.

Lamium maculatum L. Dajti, meadow in limestone hills, 1220 m., 26.5.34, No. 40.

Salvia officinalis L. Near Dajti and Tiranë hills, among rocks, 920 m., 28.5.34, No. 63. Dajti, limestone range of hills, flowers found in meadows there, 1220 m., 26.5.34, No. 25.

Salvia Tenorii Spreng. Pugil i. 2 (1813) sensu Hal. Lushnija, May 1934, sine numero. The Albanian material (see also Alston and Sandwith 1255) is not quite the equivalent of the Italian. There is, however, no doubt that it is conspecific with some at least of the Greek material included in the species of Halácsy (Consp. i. 488 ; 1902).

Stachys recta L. Dajti and Tiranë hills, in meadow, 920 m., 28.5.34, No. 61. The material is insufficient to determine the variety with certainty.

Teucrium polium L. Sand dunes near Durazzo, 10.6.34, No. 133.

Euphorbia Myrsinites L. Dajti, in meadows and among limestone rocks of range Dajti above Tiranë, Central Albania, 920 m., 28.5.34, No. 51. Dajti above Tiranë, 1670 m., 27.5.34, No. 84.

Euphorbia polychroma Kern. Limestone slope leading to peak of Dajti, 1070 m., 27.5.34, No. 115.

Gymnadenia conopsea R. Br. Limestone slope leading to peak of Dajti, 1070 m., 27.5.34, No. 118.

Orchis coriophora L. Near Durazzo, growing in amongst some low shrubs on grass slope near sea, 12.5.34, No. 7.

Orchis morio L. Dajti, limestone hills, in meadows, 26.5.34, 1220 m., No. 27. Dajti and Tiranë hills in meadow, 920 m., 28.5.34, No. 78. Dajti and Tiranë hills in meadow, 920 m., 28.5.34, No. 79, (floribus albis).

Orchis palustris Jacq. Sand dunes near Durazzo, 10.6.34, No. 137.

Orchis tridentata Scop. Dajti, limestone hills, 1220 m., 26.5.34, No.26.

Platanthera bifolia (L.) Rchb. Near Dajti and Tiranë hills, in meadows, 920 m., 28.5.34, No. 69.

Serapias laxiflora Chaub. On way down from Dajti to Tiranë, 460 m., 28.5.34, No. 125.

Gladiolus paluster Gaud. Near Durazzo, near sea level, on sand dunes with thin layer of mould vegetation, 13.5.34, No. 12.

Iris pallida Lam.x *variegata* L. (?) (±*I. neglecta* Horn. Bot. Mag. t. 2435). Dajti above Tiranë, 1670 m., 27.5.34, No. 91. This plant is identical with *Alston and Sandwith* 385 from near summit of mountain east of Krystallopegae (Smrdesh), 1520 m. There is a large range of bearded Irises found, often in apparently wild spots in the Balkan Peninsula. At present the incomplete collecting, the often poor herbarium specimens, and the insufficiency of localized material in cultivation make it impossible to do more than suggest that hybridization has been a cause of the diversity of characters and character combinations. How far the present distribution of these Irises is due to their cultivation by Turks and Slavs it is difficult to say, but vegetative propagation by dispersal of small pieces of rhizome is an easy matter.

Iris Sintenisii Janka. Lushnija, May, 1934, sine numero.

Asphodelus albus Mill. Dajti above Tiranë, 1670 m., 27.5.34, No. 93.

Muscari comosum (L.) Mill. Dajti, on limestone slope leading up to the peak of Dajti, slope open and exposed, 1070 m., 27.5.34, No. 119.

Muscari neglectum Guss. Dajti above Tiranë, 1670 m., 27.5.34, No. 95.

Polygonatum sp. (? *P. officinale* All.) Limestone slope leading to peak of Dajti, 1070 m., 27.5.34, No. 106.

Bothriochloa decipiens (*Hack.*) *C. E. Hubbard,* comb. nov. *Andropogon pertusus* var *decipiens* Hack. in DC. Monogr. Phan. **6,** 483 (1889). *A. decipiens* Domin in Biblioth. Bot. **20,** heft 85, 266 (1915).

Distrib.—Queensland and New South Wales.

This species was included under *Andropogon pertusus* Willd. by Bentham (Fl. Austral. **7,** 530 : 1878). *B. decipiens* differs from *B. pertusa* (Willd.) A. Camus in having more hairy racemes, longer and narrowly lanceolate sessile spikelets and in the narrow linear pedicelled spikelets being sterile and reduced to the lower glume. In New South Wales and Queensland *B. decipiens* is considered unpalatable, except in its early stages of growth. In some districts, where overstocking and consequently heavy grazing has taken place, it dominates the grazing land. This is especially the case in many parts of coastal southern Queensland.

Bothriochloa decipiens var. **cloncurrensis** (*Domin*) *C. E. Hubbard,* comb. nov. *Andropogon decipiens* Domin var. *cloncurrensis* Domin in Biblioth. Bot. **20,** heft 85, 266 (1915).

Distrib.—North and Central Queensland.

Allied to *B. decipiens,* but a stouter grass with taller culms and longer leaf-blades.

Bothriochloa Ewartiana (*Domin*) *C. E. Hubbard,* comb. nov. *Andropogon Ewartianus* Domin in Biblioth. Bot. **20,** heft 85, 269 (1915).

Distrib.—Western Queensland.

Bothriochloa erianthoides (*F. Muell.*) *C. E. Hubbard,* comb. nov. *Andropogon erianthoides* F. Muell. Fragm. Phyt. Austral. **10,** 75 (1876).

Distrib.—Queensland and New South Wales.

Distinguished from all other Australian species by the densely villous racemes, the long silky hairs from the joints, pedicels and calli almost concealing the spikelets.

Vetiveria elongata (*R. Br.*) *Stapf* ms., comb. nov. *Holcus elongatus* R. Br. Prodr. 200 (1810). *Sorghum elongatum* Beauv. Agrost. 178 (1812). *Andropogon elongatus* Spreng. Syst. Veg. **1,** 287 (1825). *Chrysopogon elongatus* Benth. Fl. Austral. **7,** 538 (1878).

Distrib.—Northern Australia, Northern Queensland.

Vetiveria filipes *C. E. Hubbard,* sp. nov.; affinis V. *elongatae* Stapf, sed culmis brevioribus, foliorum laminarum marginibus minus scabridis, panicula laxiore, ramis longioribus gracilibus laxe spiculatis, spicularum sessilium callo breviter barbato, aristis

*Continued from K.B., 1934, 128.

longioribus differt.—*Chrysopogon elongatus* Benth. var. *filipes* Benth. Fl. Austral. **7,** 539 (1878). *Andropogon elongatus* Spreng. var. *filipes* Hack. in DC. Monogr. Phan. **6,** 565 (1889).

Distrib.—Central and Southern Queensland [Balonne River, *Mitchell* (type)].

Germainia flosculosa (*F. Muell.*) *C. E. Hubbard*, comb. nov. *Anthistiria flosculosa* F. Muell. Fragm. Phyt. Austral. **10,** 75 (1876).

Distrib.—Queensland : Port Curtis District ; Gladstone, *Moore.*

It has been possible, through the courtesy of the Director of the Melbourne Herbarium, to examine the material on which this species was based. Bentham (Fl. Austral. **7,** 542) was unable to deal with this plant satisfactorily and briefly referred to it in a note under *Anthistiria*. Although the specimen is fragmentary, there is no doubt that it is a species of *Germainia*. The addition of an Australian species considerably extends the distribution of this genus. It is now known from Assam, Burma, S.E. China, Indo-China, Siam and Queensland. *Germainia* may be distinguished from *Themeda* (*Anthistiria*) by the solitary espatheate terminal inflorescence, the false involucre of up to 9 awnless male spikelets surrounding and more or less enclosing the 3 central fertile awned spikelets. It is hoped that Queensland botanists will be able to rediscover this very interesting species.

Ottochloa gracillima *C. E. Hubbard*, sp. nov.; affinis *O. nodosae* (Kunth) Dandy, sed spiculis multo minoribus, foliis et paniculis brevioribus, culmis gracillimis debilibus differt.

Gramen perenne. *Culmi* e basi procumbente geniculato-ascendentes, e nodis inferioribus radicantes, usque ad 30 cm. alti, debiles, gracillimi, teretes, simplices vel laxe ramosi, multinodes, tenuissime striati, uno latere pilis mollibus e tuberculis minutis ortis pubescentes vel glabri laevesque. *Foliorum vaginae* internodiis multo breviores, tenuissime striatae, marginibus ciliolatae ; ligulae brevissimae, membranaceae ; laminae lineares vel lineari-lanceolatae, basi abrupte contractae, in apicem acutum vel subobtusum attenuatae, 1–7 cm. longae, 1·5–6 mm. latae, planae, patentes, tenues, virides, supra aspere nervosae vel fere laeves, pilis paucis sparsis praeditae vel glabrae vel fere glabrae. *Panicula* laxa, 3–9 cm. longa ; axis primarius gracillimus, flexuosus ; rami 3–6, laxe spiculati, minute scaberuli, inferiores usque ad 3·5 cm. longi, plerumque ramulis brevibus 2–4-spiculatis ramosi, superiores breviores simplices ; pedicelli laterales usque ad 1 mm. longi. *Spiculae* anguste ellipticae vel oblongo-ellipticae, obtusae, dorso compressae, 2–2·3 mm. longae, pallide virides. *Glumae* subsimiles, ovatae, obtusae vel subacutae, tenuiter membranaceae ; inferior 1 mm. longa, 3-nervis ; superior usque ad 1·3 mm. longa, 3–5-nervis. *Anthoecium inferum* : lemma spiculae aequilongum, anguste ellipticum, obtusum, membranaceum, 7-nerve, glabrum vel margines versus pilis paucis brevissimis praeditum. *Anthoecium superum* anguste ellipticum : lemma obtusum, apiculatum, minute granulosum.

Queensland : Moreton District ; Blackall Range, April 1918, *White* ; Palmwoods, on grassy banks under trees in cleared Eucalyptus forest country, May 1930, *Hubbard* 2807 ; One Mile Creek, Lawnton, edge of rain-forest, near water, Jan. 1931, *Blake* 128B ; Ferny Flats, April 1918, *Shirley & White* ; between Northgate and Nudgee, April 1907, *White* ; Kedron Brook, April 1918, *White* ; Ekibin Creek, Feb. 1913, *White* ; Mt. Coot-tha, Taylor Range, in partial shade of shrubs and trees in Eucalyptus forest, April 1930, *Hubbard* 2005 ; Mt. Petrie, Eucalyptus forest, damp shady depression, April 1930, *Hubbard* 2144 ; near Mt. Gravatt, in shade of bushes and trees, in rather damp places in Eucalyptus forest, March 1931, *Hubbard* 8070, *White* 7265 ; Cooper's Plains, in Eucalyptus forest, forming dense masses under bushes, April 1930, *Hubbard* 2341 ; Sunnybank, March 1918, *White* ; Moggill, on hills in open Eucalyptus forest, in shade, April 1931, *Hubbard* 8600 (type), *White* 7617 ; Tambourine Mountain, Feb. 1917, *Longman & White*. Wide Bay District : Kin Kin, March 1916, *Francis & White*.

Brachiaria Gilesii (*Benth.*) Chase in Contrib. U.S. Nat. Herb. **22,** 35 (1920). *Panicum Gilesii* Benth. Fl. Austral. **7,** 477 (1878). *Urochloa Gilesii* D.K. Hughes in Kew Bull. 1923, 319.

Distrib.—Central Australia, South Australia, New South Wales and Queensland.

The orientation of the spikelets indicates that this species should be placed in *Brachiaria*. The lower glume is adaxial, whereas in *Urochloa* it is abaxial.

Brachiaria notochthona *Stapf* in Prain, Fl. Trop. Afr. **9,** 597 (1920), in obs. *Panicum helopus* Benth. Fl. Austral. **7,** 476 (1878), non Trin. *Panicum notochthonum* Domin in Fedde, Repert. **10,** 60 (1911). *Urochloa notochthona* D. K. Hughes in Kew Bull. 1923, 319.

Distrib.—New South Wales and Queensland.

The spikelets in this species are also adaxial and the species was correctly placed in *Brachiaria* by Stapf.

Brachiaria Whiteana (*Domin*) *C. E. Hubbard* comb. nov. *Panicum Whiteanum* Domin in Biblioth. Bot. **20,** heft 85, 305 (1915).

Distrib.—Queensland.

Brachiaria praetervisa (*Domin*) *C. E. Hubbard*, comb. nov. *Panicum adspersum* Benth. Fl. Austral. **7,** 481 (1878), non Trin. *Panicum praetervisum* Domin in Biblioth. Bot. **20,** heft 85, 309 (1915). *Urochloa praetervisa* Hughes in Kew Bull. 1923, 319.

Distrib.—South and Central Australia.

Paspalidium caespitosum *C. E. Hubbard*, sp. nov.; a *P. gracili* (Trin.) Hughes differt culmis dense caespitosis, spiculis paullo minoribus.

Gramen perenne, dense caespitosum. *Culmi* erecti, circiter 45 cm. alti, gracillimi, teretes, simplices vel ramosi, 3–6-nodes, glabri laevesque. *Folia* pilis e tuberculis minutis ortis pubescentia vel glabrescentia ; vaginae internodiis demum breviores ; ligulae ad seriem ciliorum minutorum redactae ; laminae anguste lineares, tenuiter acutae, usque ad 12 cm. longae, convolutae vel involutae, explanatae usque ad 1·5 mm. latae, subrigidae, erectae, virides. *Inflorescentia* angustissima, erecta, usque ad 16 cm. longa ; axis primarius gracillimus, laevis ; racemi 7–10, inferiores usque ad 2·5 cm. longi et 3–4·5 cm. distantes, superiores breviores et minus distantes, simplices vel longiores basi ramosi ; rhachis triquetra, angulis scaberulis, flexuosa, seta 1–2 mm. longa terminata ; pedicelli brevissimi, apice discoidei. *Spiculae* biseriatae, contiguae, ovato- vel elliptico-oblongae, subacutae, 1·8–2 mm. longae, glabrae, pallidae. *Glumae* membranaceae ; inferior late oblata, rotundato-obtusa, 0·6–0·8 mm. longa, 1–3-nervis ; superior late elliptica, obtusa, spiculae duas vel tres partes aequans, 5-nervis. *Anthoecium inferum* sterile : lemma spiculae aequilongum, late ellipticum, obtusum, membranaceum, 5-nerve ; palea minuta vel nulla. *Anthoecium* superum ♀, ellipticum, acutum, apiculatum, spiculae aequilongum : lemma et palea tenuiter crustacea ; lemma 5-nerve, tenuissime rugulosum ; antherae 0·8–1 mm. longae.

QUEENSLAND : Darling Downs District ; near Goondiwindi, May 1933, *Hirschfeld*.

According to Dr. E. Hirschfeld this species is known locally as " Brigalow Grass." He states that it is confined to Brigalow (*Acacia harpophylla*) country, where it spreads rapidly and lasts throughout the summer months.

Paspalidium Clementii (*Domin*) *C. E. Hubbard*, comb. nov. *Panicum Clementii* Domin in Journ. Linn. Soc., Bot. **41,** 272 (1912) et in Biblioth. Bot. **20,** heft 85, 303 (1915).

Distrib.—Western Australia.

Miss Hughes in her paper " The Genus Panicum of the Flora Australiensis " (K.B. 1923, 331) listed *Panicum Clementii* Domin as an " Imperfectly known Species," failing to connect a specimen determined by Domin as " Panicum n. sp." with the plant he later described as *Panicum Clementii*. This specimen, which was collected by Dr. E. Clement in Western Australia between the Ashburton and Yule Rivers, agrees perfectly with Domin's description and there seems no doubt that it is the type of his species. *Paspalidium Clementii* is closely allied to *P. gracile* (R.Br.) Hughes, but differs in being a loosely tufted annual, with compressible culms, thin and broader leaf-blades, and obscurely nerved obtuse spikelets. *P. gracile* is a perennial, with rigid wiry culms, narrower and firmer leaf-blades, densely clustered spikelets, the latter prominently nerved and with apiculate tips.

Paspalidium constrictum (*Domin*) *C. E. Hubbard*, comb. nov. *Panicum constrictum* Domin in Biblioth. Bot. **20,** heft 85, 302 (1915).

Distrib.—Central Queensland.

The type-specimen, kindly lent for examination by Dr. Domin, shows that this species is allied to *Paspalidium gracile* var. *rugosum* Hughes. It differs in its hairy leaves, slightly larger subovoid spikelets and 9-nerved upper glume. In the original description of *P. constrictum*, the nervations of glumes two and three have been transposed.

Paspalidium tabulatum (*Hack.*) *C. E. Hubbard*, comb. nov. *Panicum tabulatum* Hack. in Engl. Bot. Jahrb. **6,** 234 (1885).

Distrib.—Western Australia.

This is an annual species with loosely tufted very slender culms. It differs from *Paspalidium Clementii* in its narrower almost setaceous leaves and larger acute spikelets.

Brachyachne convergens (*F. Muell.*) *Stapf* in Hook. Ic. Plant. **31,** sub tab. 3099 (1922). *Cynodon convergens* F. Muell. Fragm. Phyt. Austral. **8,** 113 (1873). *Capriola convergens* O. Kuntze, Rev. Gen. Pl. **2,** 764 (1891). *Microchloa convergens* Domin in Fedde, Repert. **10,** 119 (1911).

Distrib.—Queensland and Northern Australia.

The genus *Brachyachne* was first proposed by Stapf in the key to the genera of tropical African grasses (Prain, Fl. Trop. Afr. **9,** 20 : 1917). Later he described a new species, *B. fulva* (Hook. Ic. Plant. **31,** tab. 3099 : 1922) from the Belgian Congo and at the same time transferred *Cynodon convergens* F. Muell. to *Brachyachne*. His new genus was apparently based on *Cynodon* Pers. sect. *Brachyachne* Benth. (Benth. et Hook. f. Gen. Pl. **3,** 1164 : 1883). It is closely allied to *Cynodon* and differs by both glumes being keeled and longer than the thin delicate lemma.

Brachyachne tenella (*R. Br.*) *C. E. Hubbard*, comb. nov. *Cynodon tenellus* R. Br. Prodr. 187 (1810). *Capriola tenella* O. Kuntze, Rev. Gen. Pl. **2,** 764 (1891). *Microchloa tenella* Domin in Fedde, Repert. **10,** 119 (1911).

Distrib.—Queensland and Northern Australia.

Brachyachne ciliaris (*Benth.*) *C. E. Hubbard*, comb. nov. *Cynodon ciliaris* Benth. Fl. Austral. **7,** 610 (1878). *Capriola ciliaris* O. Kuntze, Rev. Gen. Pl. **2,** 764 (1891). *Microchloa ciliaris* Domin in Biblioth. Bot. **20,** heft 85, 364 (1915).

Distrib.—Western Queensland, Central Australia, northern South Australia, New South Wales.

Tripogon loliiformis (*F. Muell.*) *C. E. Hubbard*, comb. nov. *Festuca loliiformis* F. Muell. Fragm. Phyt. Austral. **8,** 128 (1873). *Leptochloa loliiformis* F. Muell. l.c., in syn. *Diplachne loliiformis* F. Muell. ex Benth. Fl. Austral. **7,** 618 (1878).

Distrib.—Queensland, New South Wales, South, Central and Western Australia.

Eragrostis lanipes *C. E. Hubbard*, sp. nov.; affinis *E. eriopodae* Benth., sed spiculis brevioribus usque 10-floris, lemmatibus arcte imbricatis latioribus marginibus infra medium ciliatis, palearum carinis dense ciliatis differt.

Gramen perenne, dense caespitosum, usque ad 50 cm. altum. *Culmi* erecti vel leviter geniculati, teretes, graciles, simplices, 2-nodes, glabri laevesque, basi bulbiformi cataphyllis late ovatis acutis brevibus papyraceis basi lanatis dense obtecti. *Folia* glabra, subglauca ; vaginae internodiis breviores, arcte appressae, asperulae ; ligulae ad seriem ciliorum minutorum redactae ; laminae anguste lineares, in apicem subobtusum attenuatae, usque ad 10 cm. longae et 2·5 mm. latae, rigidae, planae vel siccitate involutae, scaberulae vel subtus fere laeves. *Panicula* aperta, laxa, 10–20 cm. longa, 3–8 cm. (vel ultra) lata ; rhachis stricta, rigida, glabra, laevis ; rami rigidi, stricti, laeves, demum horizontaliter patentes, inferiores usque ad 7 cm. longi et usque ad 4·5 cm. distantes, superiores breviores ; ramuli paucispiculati, usque ad 1 cm. longi, laxe dispositi ; pedicelli brevissimi. *Spiculae* oblongae vel ovato-oblongae, obtusae, 4–6 mm. longae, 2–3 mm. latae, purpureae vel purpureo-variegatae, usque 10-florae ; rhachilla demum disarticulans. *Glumae* explanatae late elliptico-oblongae, apice rotundatae, uninerves, basi ciliolatae ; inferior 1·3–1·5 mm. longa ; superior 1·5–2 mm. longa. *Lemmata* explanata late ovata vel late elliptico-ovata, apice rotundata, mucronulata, 2-2·3 mm. longa, carinata, prominenter 3-nervia, tenuiter coriacea, marginibus infra medium ciliata. *Paleae* oblongae, apice late rotundatae vel truncatae, 2 mm. longae, membranaceae, carinis dense ciliatae. *Antherae* 3, 1 mm. longae.

Western Australia : Tenindewa, between Geraldton and Mullewa, *Palmer*.

Poa queenslandica *C. E. Hubbard*, sp. nov.; affinis *P. australi* R.Br., sed culmis laxe caespitosis plerumque geniculatis ramosis 5–9-nodibus, foliorum laminis planis latioribus laevibus vel fere laevibus differt.

Gramen perenne, laxe caespitosum. *Culmi* geniculato-ascendentes vel erecti, 50–120 cm. (vel ultra) alti, graciles vel validiusculi, 5–9-nodes, simplices vel ramosi, glabri laevesque. *Foliorum vaginae* internodiis demum breviores, laxae, striatae, glabrae laevesque ; ligulae truncatae, tenues, usque ad 4 mm. longae ; laminae lineares, tenuiter acutae, usque ad 40 cm. longae, 4–15 mm. latae, planae, virides, glabrae, laeves vel supra apicem versus et marginibus scaberulae. *Panicula* laxa, 12-30 cm. longa, usque ad 16 cm. lata, viridis ; rhachis laevis ; rami patentes, inferiores 5–6-nati, gracillimi, minute scaberuli vel laeves, laxe divisi ; pedicelli laterales usque ad 8 mm. longi. *Spiculae* lanceolatae vel oblongae, 3–5 mm. longae, laxe 2–4-florae. *Glumae* subobtusae vel acutae, carinis scaberulae ; inferior lanceolata vel ovata, 1·5–2 mm. longa, 1–3-nervis ; superior ovata vel ovato-elliptica, 2–2·2 mm. longa, 3-nervis. *Lemmata* ambitu lanceolato-oblonga, obtusa vel subacuta, 2·5–3 mm. longa,

prominenter 5-nervia, asperula, basi minute pilosa. *Paleae* carinis scaberulae, lemmatibus aequilongae vel leviter longiores. *Antherae* 1–1·3 mm. longae. *Caryopsis* 1·8 mm. longa.

QUEENSLAND: Moreton District; Mt. Mistake, *Bailey*, *White*; Darling Downs District; Killarney, *White*; Spring Creek, near Killarney, on mountain slope, in rain forest, at foot of water-fall amongst basaltic boulders, March 1931, *Hubbard* 5783 (type).

Enneapogon avenaceus (*Lindl.*) *C. E. Hubbard*, comb. nov. *Pappophorum avenaceum* Lindl. in Mitch. Journ. Trop. Austral. 320 (1848).

Distrib.—Queensland, South and Central Australia, New South Wales.

Enneapogon Lindleyanus (*Domin*) *C. E. Hubbard*, comb. nov. *Pappophorum Lindleyanum* Domin in Biblioth. Bot. **20,** heft 85, 379 (1915).

Distrib.—Queensland, Northern Australia and Central Australia.

Glyceria Drummondii (*Steud.*) *C. E. Hubbard*, comb. nov. *Porroteranthe Drummondii* Steud. Syn. Pl. Glum. **1,** 287 (1854).

WESTERN AUSTRALIA: Swan River, *Drummond*, 277! 390! without precise locality, *Palmer* 22!

This very distinct species was referred to by Bentham (Fl. Austral. **7,** 658: 1878) under *Glyceria fluitans* (L.) R. Br., where he stated that it appeared to be a variety or small leafy state of that species. It differs from *G. fluitans* noticeably in the structure of the spikelets. The glumes are very much reduced, the lower being 0·5–1 mm. and the upper 1·5–2·5 mm. long; the lemmas taper upwards and are ovate-oblong when opened out; the paleas are 8–9 mm. long, conspicuously longer than the lemmas and have scaberulous keels; the internodes of the rhachilla are elongated and up to 4 mm. long. Finally, the specimens available suggest that it may be an annual rather than a perennial.

Glyceria australis *C. E. Hubbard*, sp. nov.; affinis *G. acutiflorae* Torr., sed spiculis latioribus, rhachilla flexuosa, paleis brevioribus lemmatibus subaequalibus carinis angustius alatis differt.

Gramen perenne aquaticum, usque ad 60 cm. (vel ultra) longum. *Culmi* e basi procumbente ascendentes, e nodis radicantes, graciles, teretes, simplices, 4–6-nodes, glabri laevesque. *Folia* glabra, laevia, prominenter transverse nervosa; vaginae laxae, striatae, demum internodiis breviores; ligulae usque ad 5 mm. longae, truncatae, tenuiter membranaceae; laminae lineares, obtusae, usque ad 18 cm. longae, 2–5 mm. latae, planae, firmae, virides. *Panicula* angusta, laxissima, interrupta, usque ad 27 cm. longa; rhachis gracilis, laevis; rami binati vel apicem versus solitarii, simplices, 1-spiculati, valde inaequales, 0·2–2 cm. longi. *Spiculae* lineares, 20–35 mm. longae, laxe 7–12-florae, pallide

virides, glabrae. *Glumae* lanceolatae, acutae, tenuiter membranaceae, 1-nerves ; inferior 4–5·5 mm. longa ; superior 6–7 mm. longa. *Lemmata* explanata lanceolata, acuminata, 7–10 mm. longa, apice marginibusque hyalinis exceptis firme membranacea, 7-nervia, asperula. *Rhachilla* flexuosa, gracillima, internodiis 2–3 mm. longis. *Paleae* lineares vel lineari-lanceolatae, apice bicuspidatae, lemmati subaequilongae, carinis inferne anguste alatis scaberulis. *Antherae* lineares, 3 mm. longae. *Caryopsis* anguste oblonga, 3·5 mm. longa.

New South Wales : Guyra, in railway reserve, in wet low-lying ground, 1320 m., *McKie* 709 ; Guyra Lagoon, in marshy place, *McKie* 709A ; Paramatta, *Woolls* ; Port Jackson, *Brown* 6296 (type).

The last two specimens cited above were identified with *Glyceria fluitans* (L.) R. Br. by Bentham (Fl. Austral. **7**, 657). They differ from that species in the prominently transversely nerved leaves and in the longer lanceolate acuminate lemmas. The remainder of the specimens cited by Bentham, from Tasmania and Victoria, are very closely connected with *G. australis*. They differ in the leaf-blades being usually obscurely and only slightly transversely nerved. They may represent a distinct form or only variations in the same species.

LV—MISCELLANEOUS NOTES.

Otto Vernon Darbishire.—We much regret to record the death of Professor O. V. Darbishire, M.A., Ph.D., F.L.S., which occurred at Bristol on October 17th, 1934, in his sixty-fifth year. Darbishire was one of the select band of professional botanists trained under Professor S. H. Vines, of Oxford. He also studied at Bangor, and at Kiel, where he commenced investigations on lichens and algae and later became Privat-Docent in the University and Assistant to Professor J. Reinke. He was at school at Dresden and Florence and always retained a broad international outlook in general as well as in botanical affairs. His great love of music was perhaps associated with the many years spent in Germany.

Darbishire's principal interests were cryptogamic botany, (especially marine algae, and lichens) ecology and physiology. For eleven years (1898–1909) he was Lecturer in Botany at Manchester University, during which time he published many important papers on lichens. After a short period (1910–1911) as a lecturer at Armstrong College, Newcastle-on-Tyne, he was appointed Lecturer at Bristol University and subsequently became Professor, the first holder of the Melville-Wills Chair of Botany. At Bristol his interest in the lower plants was again evident in the strong cryptogamic department which he built up. In spite of heavy administrative duties, he was able to continue research on his favourite subjects.

During his summer vacations of 1902 and 1903 Darbishire commenced and largely completed the re-arrangement of the entire

lichen collection at Kew, employing the classification of Reinke, Zahlbruckner's work not then being available. He was also an enthusiastic field botanist and whilst at Manchester frequently visited the Lake District and the Marine Biological Station at Port Erin in connection with lichen and algal work respectively, and to the stimulus of these excursions the present writer is indebted for a great interest in both groups. The final re-arrangement of the lichens at Kew was accomplished jointly. Though his visits to Kew became much less frequent in later years, he was always a very warm supporter of the establishment and almost every year sent or brought a class of his undergraduate students for a week's visit to the Gardens.

A. D. COTTON.

Meconopsis.*—" The purpose of this volume is to *summarise* in *convenient* form our present *knowledge* of the genus " (preface, p. ix). Mr. Taylor is to be congratulated upon having achieved the three admirable objects expressed by the words which we have italicized, in a manner at once attractive, exhaustive and convincing.

The " enumeration of the groups, species and hybrids," occupying the main body of the work (pp. 20–111), is preceded by a particularly lucid introduction (pp. 1–11) ; a generic description and distribution map (p. 12 ; the map would have been much more useful on a larger scale, with rivers and/or political boundaries); a "conspectus of species and their groups " (pp. 13, 14) ; and a " key to the species " (pp. 15–19), based on natural affinities. Since a conspectus of the natural grouping of the species is provided, a key constructed on entirely artificial characters, especially those most easily observable and likely to be most frequently observed, would perhaps have been more practical.

For each species, in the " enumeration," are given copious references under the accepted name and synonyms (including pre-Linnaean authors in the case of *M. cambrica*) ; an adequate description in English ; statement of geographical range ; and a discussion of points of interest. Four species are described as new : *M. gracilipes*, *M. pseudovenusta*, *M. Georgei* (but the Latin for " George " is *Georgius, -ii* !) and *M. neglecta*, whilst *M. villosa* is a new combination resulting from the reduction to *Meconopsis* of the genus *Cathcartia* Hook. f. For each of the ten Asiatic series of subgenus *Eumeconopsis*, and for the distinct subgenus *Discogyne* G. Taylor (consisting of two species only), a distributional map is provided, all of which are unfortunately open to the same criticism as that brought against the general map, above. Bare, unnumbered

* An Account of the Genus Meconopsis, by George Taylor, B.Sc., F.L.S., F.R.S.E.; with notes on the cultivation of the introduced species by E. H. M. Cox ; with a foreword by Sir William Wright Smith. Frontispiece, 29 plates from photographs and 12 distributional maps. Pp. xiv+130. New Flora and Silva Ltd., London, 1934. Price 20/-

parallels of latitude and longitude, and distant coast-lines, scarcely constitute an adequate system of reference.

The account is rounded off with Mr. Cox's " notes on the cultivation of the introduced species ; " an exhaustive index ; and, last but not least, a series of twenty full-page reproductions of photographs of as many species, from life (tt. i–xvii, xxiv, xxv, xxviii), supplemented by eight half-page photographs of herbarium specimens (tt. xviii–xxiii, xxvi, xxvii), whilst the final full-page plate shows a bed of young plants of four species. The photographs are good, and well reproduced—such, indeed, as we have come to associate with the name of " New Flora and Silva." In a monograph of this description, it is unusual to get complete and practical details on cultivation, and a careful study of the cultural advice tendered should not only enable lovers of *Meconopsis* to grow them more successfully, but also encourage beginners who have hitherto been afraid to take up their cultivation.

The reviewer is not in a position to offer detailed criticism of the author's taxonomy. If, however, straws indicate which way the wind blows, a " fair wind and a prosperous voyage " might be anticipated from the following passages, indicative of an eminently sane approach to the subject. " Many species are so highly polymorphic and unstable under cultivation that it may be permissible to treat the various forms merely as incipient taxonomic units which have not yet become sufficiently fixed to warrant nomenclatural recognition. The factors of time and geographical isolation may eventually bring such stability as will lead to an easier comprehension of their status. Alternatively, the flux of forms referred to certain species may be the result of continued interbreeding so that any specific differences which may formerly have existed have been obscured by repeated hybridization " (p. 3). " In many instances it will be difficult to persuade horticulturists that certain forms which they may be growing are really not specifically distinct, but the interrelation of such forms often only becomes obvious on reference to a wide range of material, such as is furnished by herbarium specimens of wild plants" (p. 4). The reviewer quotes these remarks with unqualified sympathy, having reached identical conclusions from the study of a widely different group of flowering plants.

H. K. AIRY-SHAW.

Silviculture of the Mixed Deciduous Forests of Nigeria.*— Mixed deciduous forests in Nigeria occur as a belt of varying width running parallel with the coast. This belt is situated between the typical rain or evergreen forest in the south of the colony and the deciduous forests occurring to the north. The mixed deciduous

*Silviculture of the Mixed Deciduous Forests of Nigeria with Special Reference to the South Western Provinces, by W. D. MacGregor, B.Sc., Oxford Forestry Memoirs, no. 18 (1934). Oxford University Press. Pp. 108, figs. 70. Price 15s.

forests are intermediate ecologically between these two types. They contain a large number of important timber trees and their regeneration in Nigeria is regarded as a problem of importance.

In this memoir the writer records the silvicultural knowledge that he has accumulated regarding this type of forest. Rates of growth of the important species, in both the natural forest and the plantation, are given, and various aspects of experimental silviculture dealt with. The greater part of the memoir is devoted to descriptions of the silvicultural characters of individual species, 26 indigenous and 15 exotic species being considered. In this section many new and interesting facts of general botanical interest are recorded. Those relating to the indigenous species, some of which are of wide distribution throughout West Africa, are of special significance. Information regarding times of flowering and fruit formation, seed characteristics, germination, shade requirements and seedling characters are given. The descriptions of seedlings are accompanied by a number of well executed black and white illustrations showing various stages in germination and the development of the seedling. A number of good photographs is included in the text. The work will be regarded as a useful contribution to the forestry and botany of West Africa, and is all the more creditable when it is remembered that silvicultural research was initiated in Nigeria only in 1928.

F. N. HOWES.

Hand-List of Trees and Shrubs.—The fourth edition of the " Hand-List of Trees and Shrubs (excluding *Coniferae*), cultivated in the Royal Botanic Gardens, Kew " has now been published. It has been prepared by Mr. W. J. Bean, late Curator of the Gardens, and includes many additions that have been received since the third edition appeared ten years ago.

The present list differs from the last in having the genera arranged in alphabetical order, thus bringing it into line with the other hand-lists prepared at Kew. As the families are mentioned under each genus the interests of both botanists and horticulturists are fully ensured.

In order to economise space, a slightly smaller Clarendon type is used for the retained names of genera, species and varieties; synonyms are given in Roman type. As in the last edition, approximate flowering dates are given and evergreens are indicated. Plants that are inclined to be tender at Kew are marked by an asterisk, and in the present list the word " climber " is given in the case of climbing plants.

On the whole the concepts of genera are similar to those of the former list, but a few changes have been made, particularly in the old genus *Pyrus* which has now been subdivided into *Pyrus*, *Malus*, *Sorbus* and *Aronia*. The " hardy Tecomas," which were

formerly *Tecoma* spp., are now included under *Campsis*. *Helianthemum* is also re-arranged and subdivided according to modern ideas.

The Hand-List is obtainable at or from the Royal Botanic Gardens, Kew, or from H.M. Stationery Office, price 5s. 6d. net.

The Original Drawings of Francis and Ferdinand Bauer.—In response to an enquiry from Dr. Claus Nissen of Mainz concerning the whereabouts of the original drawings of the brothers Bauer, the following note was compiled and is published here as being of interest to botanists in general.

Though Francis Bauer was resident draughtsman for fifty years at the Royal Botanic Gardens, Kew, so far as can be ascertained only seven of his original drawings are preserved here. These seven drawings were made for " Delineations of exotick plants cultivated in the Royal Garden at Kew," published by W. T. Aiton, London, 1796, and are as follow : *Erica corifolia*, *E. Leeana*, *E. coccinea*, *E. vestita*, *E. pyramidalis*, *E. tubiflora* and *E. Banksii*. There is an article on this work by James Britten in the Journal of Botany, 1899, 181, in which a list of the plates is given. We learn from this that 17 of the original finished drawings are in the Department of Botany of the British Museum (Natural History), South Kensington. By error it is stated in the article that there are 13 original drawings for the work at Kew : there are only 7.

The originals of 20 water-colour drawings illustrating the " Germination of Wheat " (1813), and 25 water-colour drawings illustrating the " Diseases of Corn " (1813), with many others, were included in the Banksian collection, and went to the British Museum in 1827, but the extensive series of drawings made at Kew after Banks's death and bequeathed to George IV, was presented to that institution in 1841 by H.M. Queen Victoria. His original drawings for the plates to Sir W. J. Hooker's " Genera Filicum," and other works including Aiton's " Hortus Kewensis " (1789), with 127 drawings of British orchids, and some illustrating the form and structure of various parts of plants, are also preserved in the British Museum. Other original drawings by Francis Bauer were purchased for the Museum in 1879, while some, illustrative of microscopic anatomy, done for Sir E. Home, were presented in 1893 by the executors of Sir R. Owen. One of the twenty-five copies of vol. 1 of A. B. Lambert's " Genus Pinus," coloured by Francis Bauer, is also in the British Museum.

There are no original drawings at Kew by Ferdinand Bauer, who accompanied Robert Brown on Flinders's voyage to Australia and brought back a series of water-colour drawings of the plants and animals observed. Forty-nine of his drawings of animals and 203 of plants were presented to the British Museum* by the Lords

* Brown's bequest also included 40 drawings of animals by Ferdinand Bauer, making a total of 89 drawings of animals by him in the Department of Zoology, British Museum.

Commissioners of the Admiralty in 1843, and two porfolios of his drawings were bequeathed to the same institution in 1858 by Robert Brown. Brown's bequest included 16 that were duplicates of drawings received from the Admiralty, thus making a total of 236 of Ferdinand Bauer's drawings of Australian plants in the British Museum. His original drawings for some of the plates to A. B. Lambert's " Genus Pinus " are also preserved in the Museum. An article on Ferdinand Bauer's drawings of Australian plants, by James Britten, was published in the Journal of Botany, 1909, 140–146. Ferdinand Bauer's original water-colour drawings, over a thousand, of the plants collected in Greece by Sibthorp, and published in Sibthorp's " Flora Graeca," three volumes of paintings of animals, birds, fishes and reptiles of Greece, which have not been published, and 131 drawings of places visited on Sibthorp's journey are in the Herbarium of the University of Oxford.

Several hundred original and published drawings and other effects of the brothers Bauer were sold by auction by Messrs. Christie & Manson, in London, on Nov. 24, 1841. No information is available as to who purchased them or their present whereabouts.

The brothers Bauer are included in J. Britten & G. S. Boulger's " A Biographical Index of Deceased British and Irish Botanists," ed. 2, revised by A. B. Rendle, 1931. In this work references are given to all the more important articles relating to them that have appeared in England.

Imperial Botanical Conference.—An Imperial Botanical Conference, commencing on August 28th and lasting 2–3 days, according to the programme which may finally be arranged, will be held in London next year. The subjects set down for discussion are of general interest to Empire botanists and include such topics as pasture research within the Empire, the ecology of tropical forests, the application of ecological methods to the study of native agriculture, problems of fruit storage and transport with special reference to tropical conditions, the furtherance of schemes for the closer co-ordination of botanical research within the Empire, etc. It is hoped that this Conference will furnish a convenient meeting ground for home and overseas botanists who are on their way to attend the International Botanical Congress which meets at Amsterdam in the week following. The Director of the Royal Botanic Gardens, Kew, is the Chairman of the Organising Committee of the Conference, and the Hon. Secretary is Professor W. Brown, Imperial College of Science and Technology, South Kensington, London, S.W.7., from whom further particulars may be obtained.

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